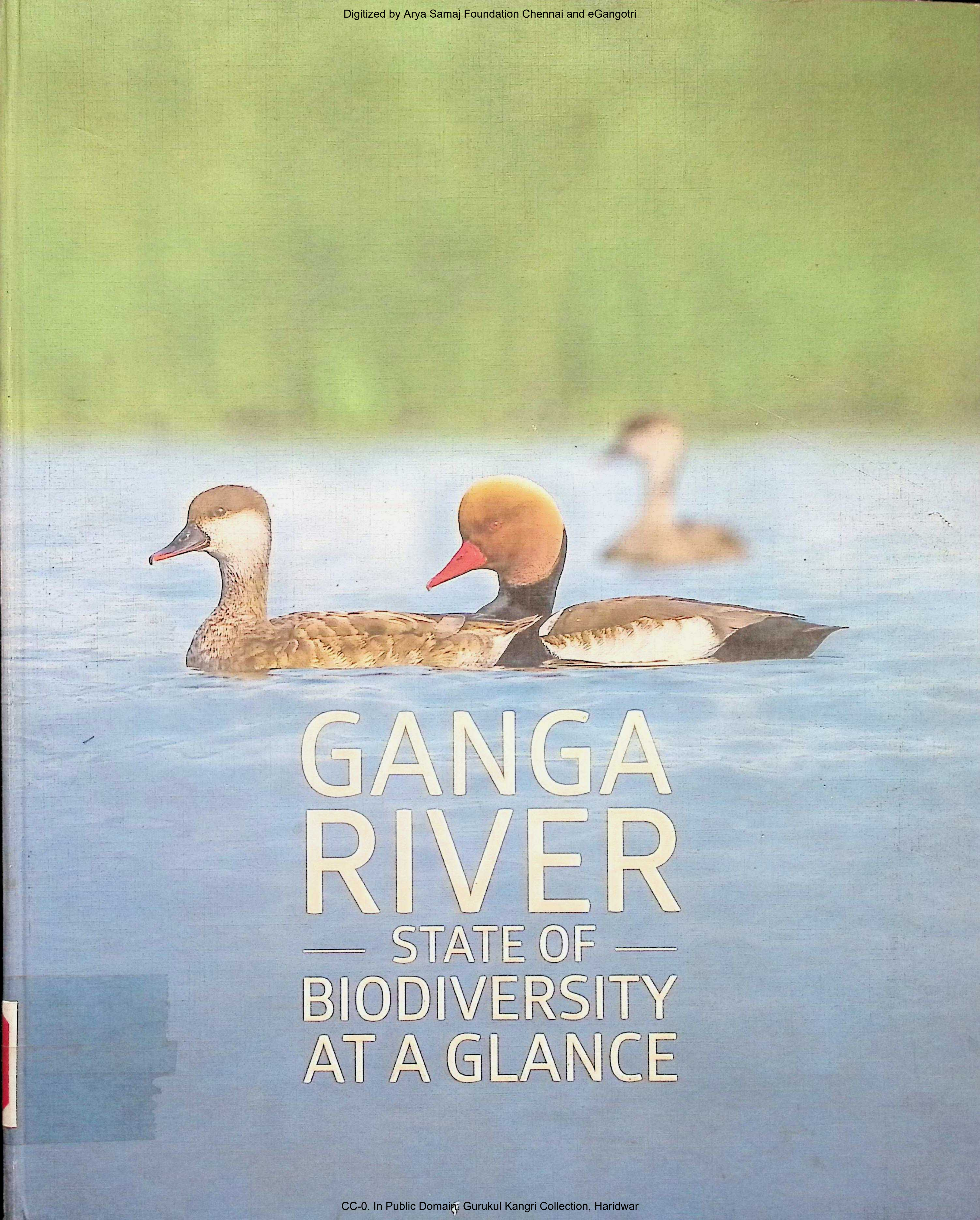

GANGA RIVER

STATE OF BIODIVERSITY AT A GLANCE

GANGA RIVER STATE OF BIODIVERSITY AT A GLANCE

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The publication "Ganga River -State of biodiversity at a glance" provides information on the select species of the Ganga River, on the basis of literature review and rapid biodiversity assessment, carried out under the National Mission for Clean Ganga funded Wildlife Institute of India's project "Biodiversity Conservation and Ganga Rejuvenation". Additionally, it provides information on the protected areas along the Ganga River, threats to the biodiversity of the river and stretches with high biodiversity values identified along the river for conservation initiatives.

नमामि गंगे

Team Leaders
V. B. Mathur and G.S. Rawat

Editors
Syed Ainul Hussain and Ruchi Badola

Text
Niladri Dasgupta, Shivani Barthwal, Michelle Irengbam,
Anita Devi, Sayantika Banerjee

Maps and Database
Zeeshan Ali, Aishwarya R. Chandran,
Ravindra Nath Tripathi, Satakshi Sharma

Editorial support
Shivani Barthwal, Michelle Irengbam, Niladri Dasgupta

Survey team
Aftab Usmani, Goura Chandra Das, Arvind Diwedi, Ajit Kumar, Narendra Mohan Katara,
Bitupan Boruah, Kritish Dey, Anuja Mittal, Prabhaker Yadav, Animesh Talukdar, Saurav Gawan,
Ajay Rawat, Megha Shruti, Umar Saeed, Syed Mujahid Ahmad, Arkojyoti Sarkar

Additional Input
Rajeev Kishore, Sandeep Behera, J. Anthony Johnson, Gopi, G.V., Gautam Talukdar, Abhijit Das

Photo credits
Abhijit Das, Arwind Dwivedi, Bivash Pandav, Ganesh Chowdhury, Goura Chandra Das, Indraneil
Das, Klaus Rudloff, Moumita Chakraborty, Narendra Mohan, Niladri Dasgupta, Pariva Dobriyal,
Rajeev Basumatary, Syed Ainul Hussain, Suyash Katdare and miscellaneous sources.

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Post Box # 18, Dehra Dun - 248 001, Uttarakhand, India
Tel: +91-135-2646100; 2640114-115; Fax: +91-135-264011[illegible]
Email: wii@wii.gov.in; gacmc@wii.gov.in
Website: http://www.wii.gov.in/wii.gov.in/nmcg/national-mission-for-clean-ganga

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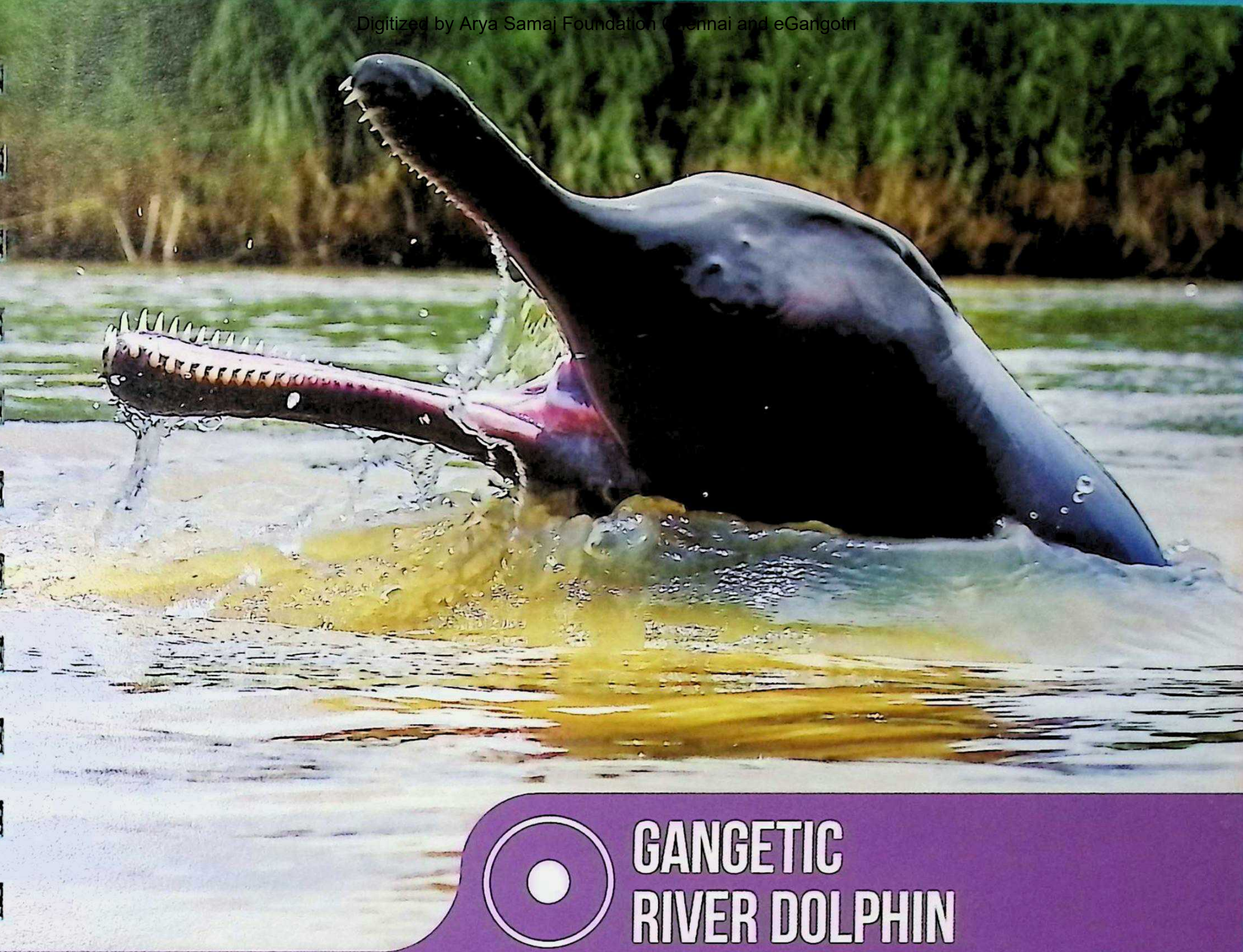
GANGETIC RIVER DOLPHIN

The Gangetic river dolphin belong to the class Mammalia,order Cetacea, andfamily Platanistidae. It occurs in the northern parts of the Indian sub-continent and inhabits the Ganga, Brahmaputra and the Meghna river systems and their major tributaries, from the tidal limits to the foothills of the Himalayas, the Garo hills of Meghalaya and the Cachar hills of Assam. It is around 2.3 to 2.6 m in length and females are generally larger than males. The body is fusiform; the head extended into a prolonged, laterally compressed beak or rostrum. The dorsal fin of this species is rudimentary forming a fleshy ridge located almost at the mid length of the body. The eyes are about the size of a pea and are devoid of crystalline lens thereby terming it as blind dolphin but the anatomical evidence suggests that the eye may likely serve as a light sensor. Its blowhole is a single longitudinal slit and the tail flukes are horizontally placed like all other Cetaceans. It uses double beam echolocation system for movement and detection of prey, which is unique to this species.

OTTERS
CROCODILIANS
TURTLES
AMPHIBIANS
FISH
CONSERVATION ISSUES



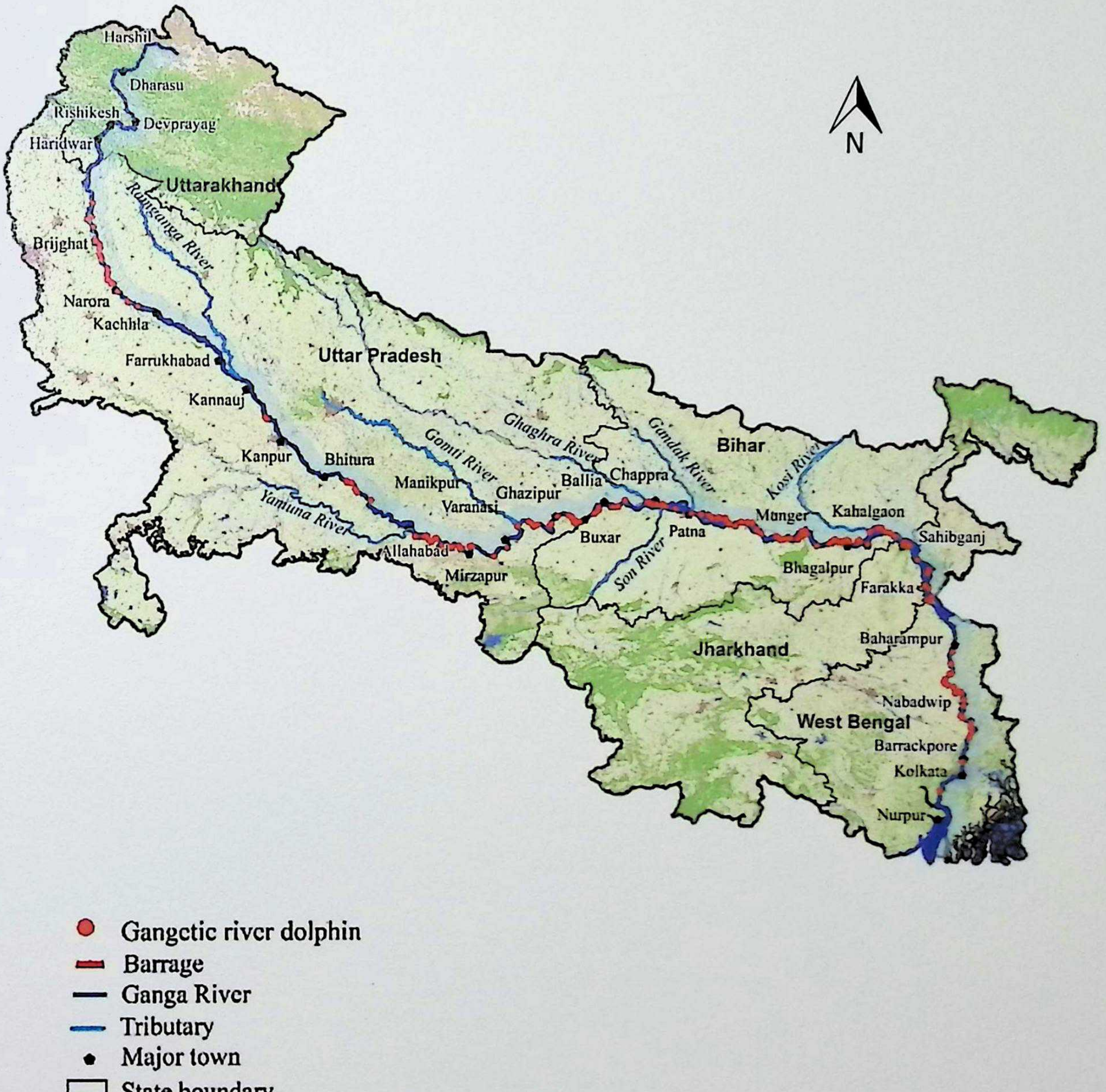
GANGETIC RIVER DOLPHIN

The Gangetic river dolphin is largely solitary and non-gregarious, occasionally found in small groups. Once occurring upstream up to Haridwar, its range has now reduced only to the deeper parts of the river downstream to the Bijnor barrage. It is an iconic as well as a flagship species. Being the top predator it shapes aquatic species communities particularly benthic and fish communities. Prey availability and water depth are limiting factors for their occurrence. Populations of the species is declining due to the construction of dams and barrages, unsustainable water abstraction, depletion of prey base, accidental mortalities in fishing nets and accidents with propellers of vessels. Continuous disturbance from movement of large vessels in the river may also cause unprecedented rapid decline in dolphin population, as has been the case of Yangtze river dolphin, which became extinct. It is also likely that modification of river habitat for navigation such as dredging, river training and canalization may damage its habitat. The species was declared as the National Aquatic Animal on 5th of October 2009. All the dolphin species found in India have been granted "non-human personhood" status by the Government of India, making India the first nation in the world to recognize the unique intelligence and self-awareness of the dolphins.

During the rapid biodiversity assessment, the species was frequently sighted between Brijghat and Narora, upstream of Kanpur, from Bhitura to Ghazipur, between Chappra and Kahalgaon, between Sahibganj and Rajmahal and from Baharampur to Barrackpore. The sightings were made in the stretches of the river where water depth ranged between 4 and 7 m.

Scientific Name	Vernacular Name	Occurrence	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Provinces	Important areas along the Ganga River
Platanista gangetica	Sus, Susu, Hihu, Shushuk	Rivers of Gangetic Plains and Brahmaputra valley	Endangered	Schedule I	Upper & Lower Gangetic Plains (7A & 7B)	Bhitura to Ghazipur, Chappra to Kahalgaon, Sahibganj to Rajmahal and Baharampur to Barrackpore

OCCURRENCE OF GANGETIC RIVER DOLPHIN ALONG THE GANGA RIVER


Harshil
Dharasu
Rishikesh
Devprayag
Haridwar
Uttarakhand
Ramganga River
Brijghat
Narora
Kachhla
Farrukhabad
Uttar Pradesh
Kannauj
Kanpur
Bhitura
Gomti River
Ghaghra River
Gandak River
Bihar
Kosi River
Manikpur
Ghazipur
Ballia
Chappra
Varanasi
Yamuna River
Allahabad
Mirzapur
Buxar
Patna
Son River
Munger
Kahalgaon
Sahibganj
Bhagalpur
Farakka
Jharkhand
Baharampur
Nabadwip
West Bengal
Barrackpore
Kolkata
Nurpur
N
● Gangetic river dolphin
Barrage
Ganga River
Tributary
Major town
State boundary

OTTERS

Otters belong to the class Mammalia, order Carnivora and family Mustelidae. A diverse group, they are characterized by the loss of the caranassial notch (on upper premolar), invariable loss of the upper molar and the enlargement of the anal sac. They are adapted to a semi-aquatic life, with webbed feet and flippers for swimming under water, valvular nostrils and an intra-narial larynx to exclude water while breathing and swallowing. Of the 13 species of otters worldwide, five species occur in Asia and of which three occur in India. The smooth-coated otter is distributed throughout the country from the Himalayas southward, but the Eurasian and Asian small-clawed otters are restricted to the Himalayas, north of the Ganga and southern India. Once abundant throughout these ranges, the population of otters is rapidly declining owing to the reclamation of wetland habitats for human settlements and agriculture, construction of large-scale hydroelectric projects, reduction in prey biomass, poaching and contamination of waterways.

Being at the apex of the food web, otters are indicators of healthy ecosystems and are the first to disappear from disturbed ecosystems.

SMOOTH-COATED OTTER

The smooth-coated otter (*Lutrogale perspicillata*) is distributed throughout southern Asia from Indonesia, through southeast Asia, and westwards through southern China, India and Pakistan, and an isolated population in Iraq. It is the most widely distributed otter species in India, occurring throughout the Gangetic plains, central Indian plateau of Maharashtra, Andhra Pradesh, and in South India. The smooth-coated otter is a large (7-12 kg) otter characterized by a very smooth, velvety pelage and is usually 1067 and 1300 mm in length from head till tail end. Tail length is more than half the length of the head and body and more than three times the length of hind foot.

The smooth-coated otter is piscivorous, occurs along large rivers and lakes, in mangrove forests along the coast and estuaries. Along the large rivers in India, it shows greater preference for rocky stretches that provide sites for den and resting. The Terai areas of the upper Gangetic plains and the seasonally flooded swamps are extensively used by smooth-coated otters during monsoon and early winters. They are gregarious, often living and hunting in large groups of different age and sex. A group of smooth-coated otters requires 7- 12 km of river as a foraging territory.

In the Ganga River, the species is found throughout the middle and lower stretches of the river and its major tributaries at locations where human induced disturbances are least. During the rapid biodiversity assessment, otter presence was recorded between Devprayag and Rishikesh, downstream of Bhimgoda barrage, at Munger and Kahalgaon.

Throughout the length of the Ganga River, suitable habitat for the species was mostly found in the undisturbed stretches, within the Protected Areas, with high vegetation cover and high fish diversity. Smooth-coated otters are elusive and diurnal in nature, and are highly sensitive to slight disturbances and changes in habitat conditions.

Scientific Name	Vernacular Name	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Provinces	Important areas along the Ganga River
Lutrogale perspicillata	Uddbilav, Udberal	Vulnerable	Schedule II	West Himalaya (2B), Upper & Lower Gangetic Plains (7A & 7B)	Devprayag to Bhimgoda barrage, Hastinapur Wildlife Sanctuary, Bijnor to Narora, Munger, Vikramshila Gangetic dolphin sanctuary

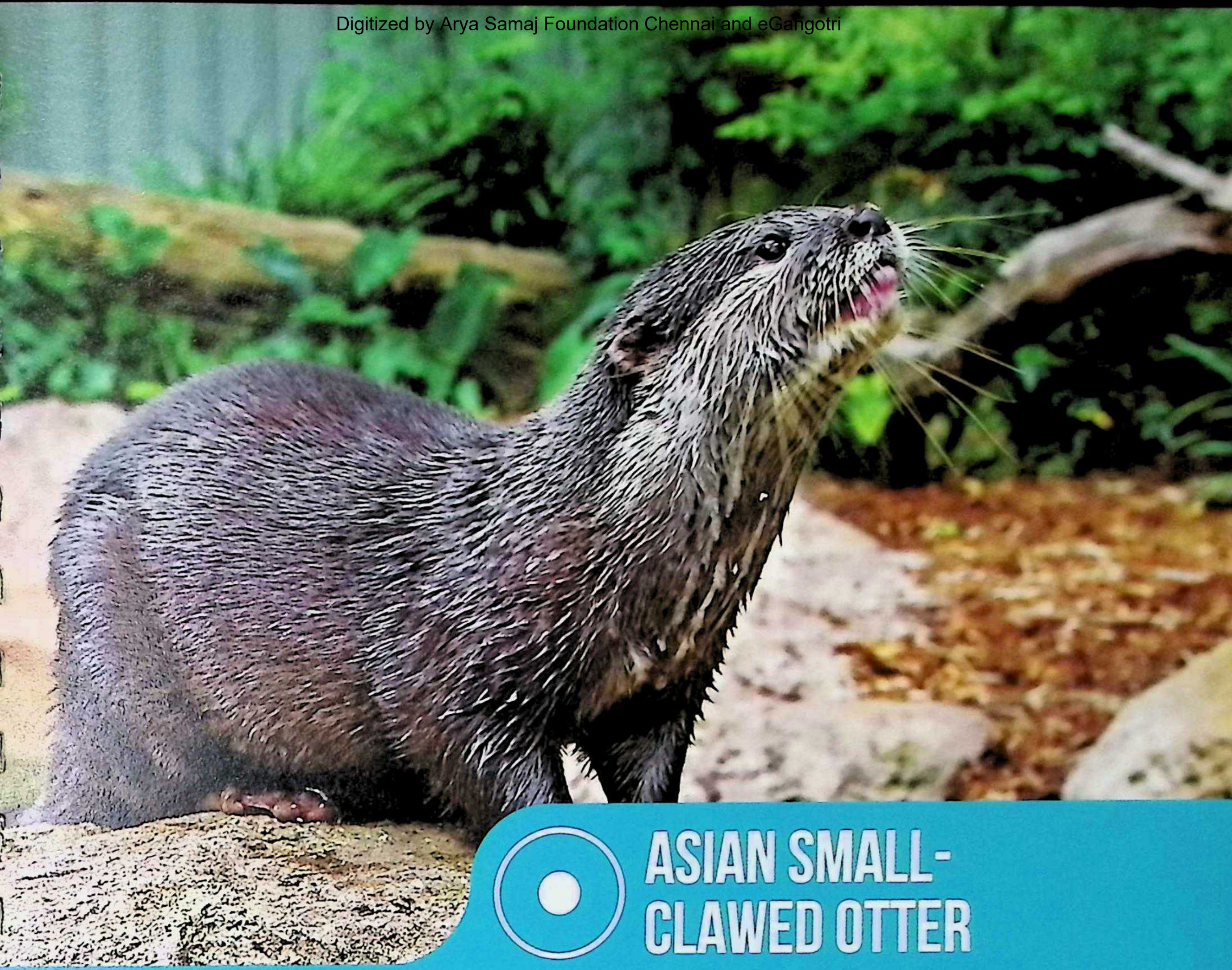
EURASIAN OTTER

The Eurasian otter (*Lutra lutra*) has the widest distribution range of all otter species, spanning parts of three continents: Europe, Asia and Africa. In India, it is distributed in Himalayas above ~750 m altitude, Western Ghats and northeast India. During summers (April - June), these otters may ascend upto 3,660 m into the Himalayas. These upward movements probably coincide with the upward migration of the carps and other fish for spawning. With the advent of winter, the otters come down to lower altitudes.

The Eurasian otter is similar to the smooth-coated otter in size but much slender, with total body length varying between 92 to120 cm, females weigh 6-12 kg and males weigh around 7-12 kg.

It is primarily nocturnal, largely solitary and lives in a wide variety of aquatic habitats, including highland and lowland lakes, rivers, streams, marshes and coastal areas. Akin to the other two species, the Eurasian otter is piscivorous. In most parts of its range, its occurrence is correlated with bank side vegetation. *Lutra lutra* is generally described as territorial and solitary, and is elusive and highly sensitive to human disturbances.

Scientific Name	Vernacular Name	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Province	Important areas along the Ganga River
Lutra lutra	**Uddbilav, Udberal**	**Near Threatened**	**Schedule II**	**West Himalaya (2B)**	**Himalayas and foothills**



ASIAN SMALL-CLAWED OTTER

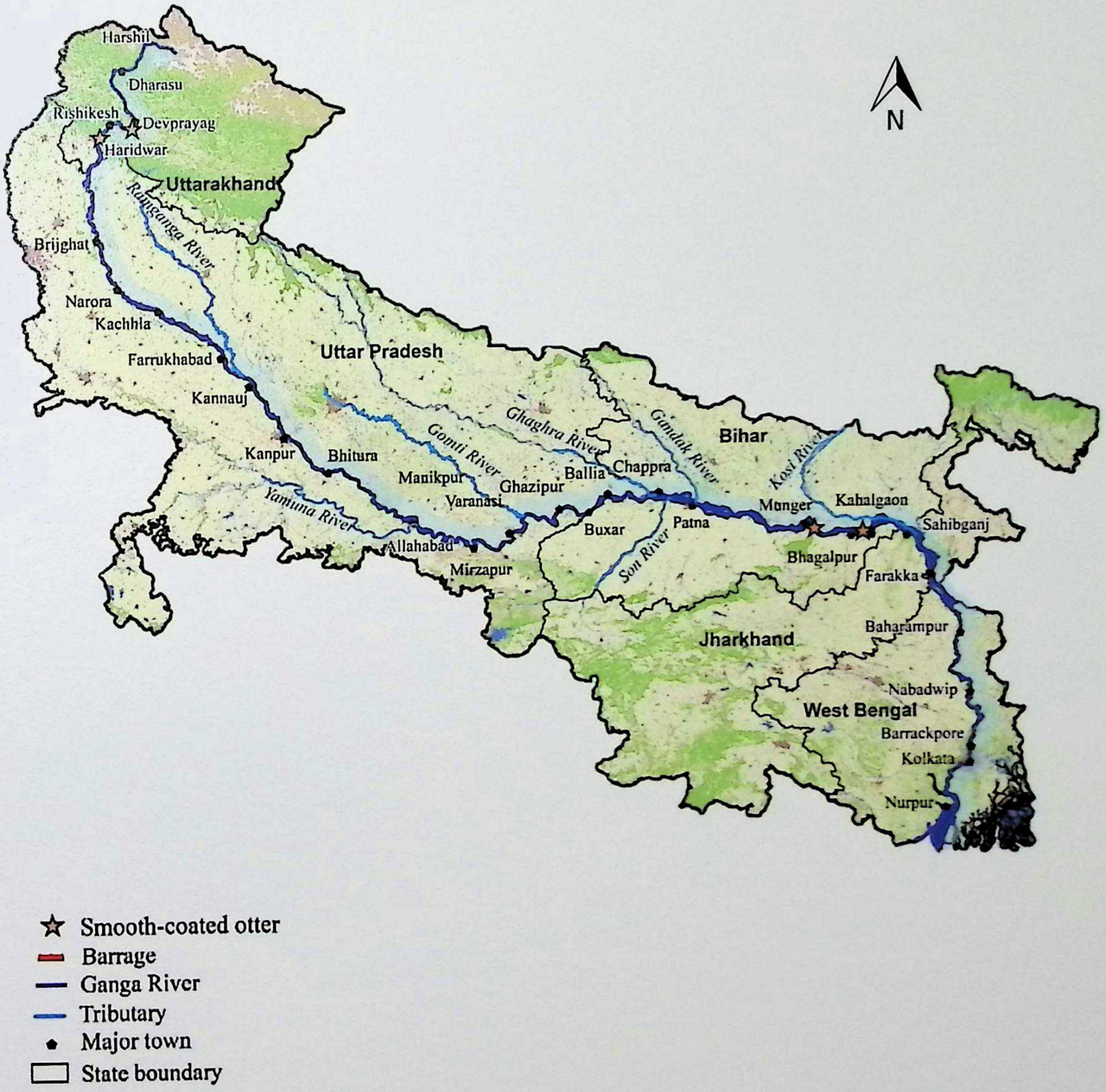
The Asian small-clawed otter (*Aonyx cinereus*) is found across much of south and southeast Asia, with a continuous population in southeast Asia, northeast India and Himalayan foothills and a disjunct population in the hill ranges of the Western Ghats. The species is reported from the narrower streams joining Ganga River in upper stretches of Uttarakhand and in smaller creeks in the Sundarbans in the lower stretch of the river.

It is smallest of the three otter species and is distinguished from the others by its considerably narrower feet, with more emarginate webs, which do not extend along the digital pads and are sparsely covered with short hair. The length of the head and body is around 40.6 to 63.5 cm, tail 24.6 to 30.4 cm and weight ranges between 2.7 to 5.4 kg.

Asian small-clawed otters are nocturnal and crepuscular. They mostly eat crabs, insects and small fish. They live and forage in groups of up to 12-13 individuals. The species is monogamous, and both parents contribute to raising the offsprings. Along rivers, Asian small-clawed otters rest, sun, and groom on grassy or sandy banks.

Scientific Name	Vernacular Name	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Provinces	Important areas along the Ganga River
Aonyx cinereus	Uddbilav, Udberal	Vulnerable	Schedule I	West Himalaya (2B) East Coast (8B)	Tributaries of the Upper Ganga and in Lower Ganga

OCCURRENCE OF SMOOTH-COATED OTTERS ALONG THE GANGA RIVER


N
Harshil
Dharasu
Rishikesh
Devprayag
Haridwar
Uttarakhand
Ramganga River
Brijghat
Narora
Kachhla
Farrukhabad
Kannauj
Uttar Pradesh
Kanpur
Bhitura
Yamuna River
Allahabad
Mirzapur
Gomti River
Manikpur
Varanasi
Ghazipur
Ghaghra River
Ballia
Chappra
Buxar
Son River
Patna
Gandak River
Bihar
Kosi River
Munger
Kahalgaon
Bhagalpur
Sahibganj
Farakka
Jharkhand
Baharampur
Nabadwip
West Bengal
Barrackpore
Kolkata
Nurpur
☆ Smooth-coated otter
Barrage
Ganga River
Tributary
● Major town
☐ State boundary

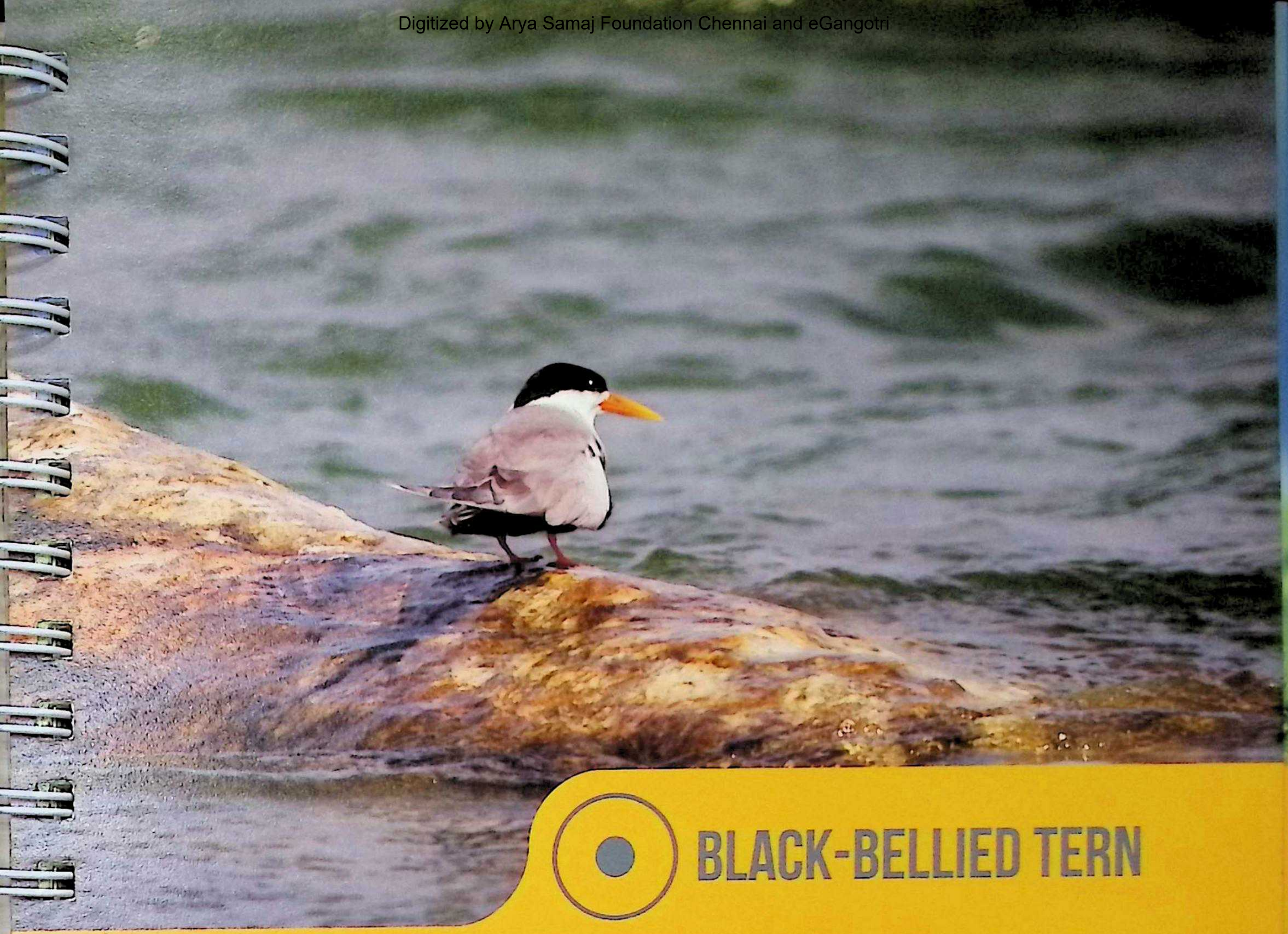
BIRDS

A global hotspot for avifaunal diversity, India harbours 1340 species of birds. The Ganga River basin supports 177 species of migratory and resident breeding birds. The avian diversity in the Ganga River includes waterbirds, water associates and terrestrial species and they can be classified as resident breeding birds and migratory birds. These birds occur from upper stretches of the Ganga River till the Sundarbans, covering several Biogeographic provinces, viz., West Himalaya (2B), Upper & Lower Gangetic Plains (7A, 7B) and East Coast (8B).

RESIDENT BREEDING BIRDS

The resident breeders are most common in the Gangetic Plains and East Coast. The resident breeding birds of the Ganga River nest and raise their fledglings on river islands, banks, sand bars and grasslands in the Gangetic floodplain. There are eight species of resident breeding birds in the Ganga River. Among these, one species each is listed as Endangered and Vulnerable, three as Near Threatened and three as Least Concern in the IUCN Red List.

They are indicators of ecosystem intactness, habitat diversity and abundance of fish and benthic macro-invertebrates.



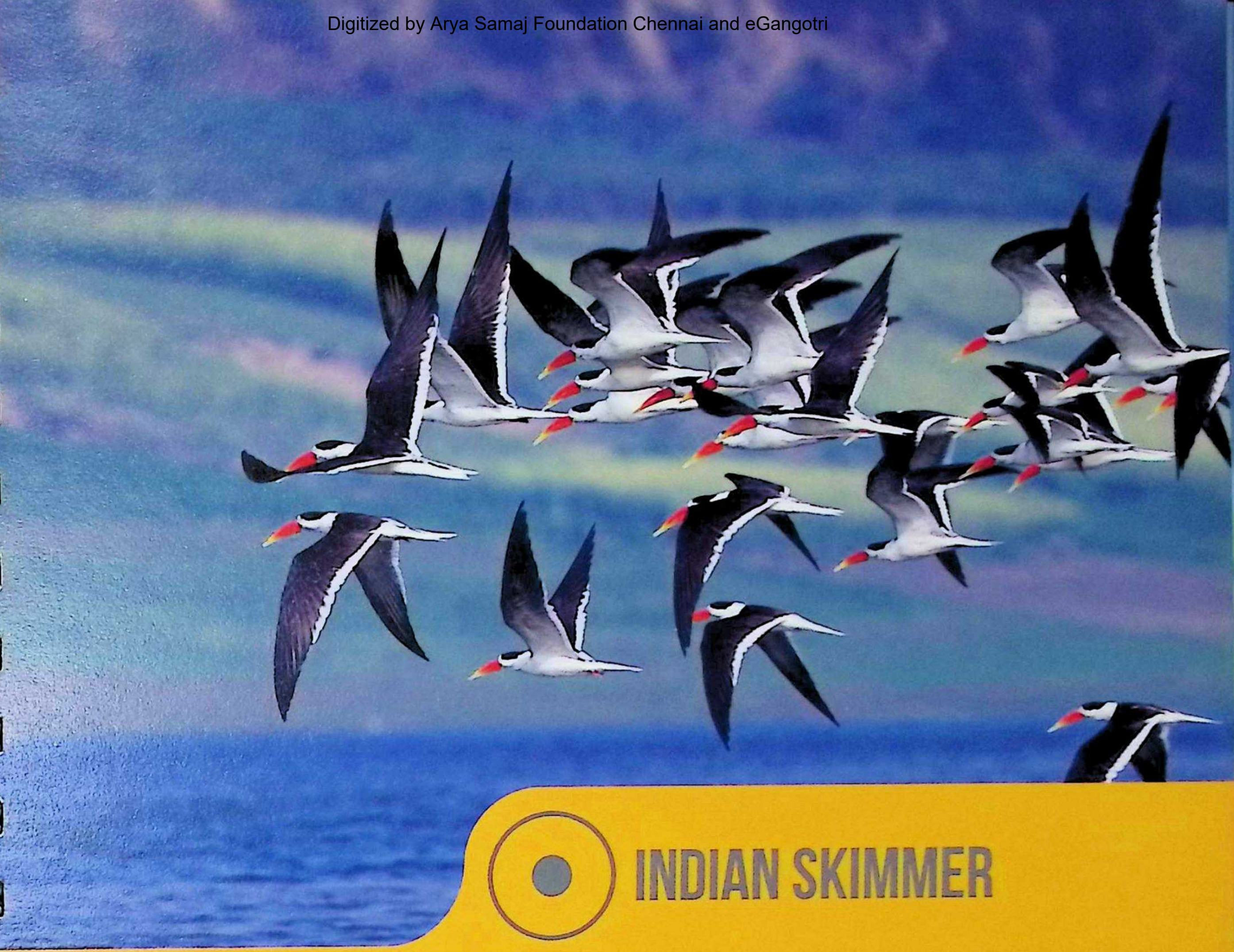
BLACK-BELLIED TERN

The Black-bellied tern (*Sterna acuticauda*) occurs throughout the Indian sub-continent to Laos, Thailand and Cambodia. The species is going through a very rapid and on-going localized decline in population and is almost extinct in China (Yunnan). The species occurs in sandy banks and mid-river sandy islands in the middle and lower stretches of the Ganga River.

It is a small bird, 32 to 35 cm in length, adults have an orange bill, black cap and nape, dark grey breast and blackish belly and vent. Breeding individuals show a whitish belly and lack tail streamers. The species breeds during February to April. It is gregarious and a colonial nester and nests on sandy beaches of mid-river islands with a clutch size of 2-3. It is an active hunter and skims over the surface of water and ground to pick up insects and plunges at an angle into the water to feed on crustaceans, tadpoles and fish.

The species is threatened due to destruction of breeding habitats caused by agriculture, sand mining and grazing, flooding of nests, human disturbance, predation by feral dogs, cats and corvids near human settlements.

Scientific Name	Vernacular Name	Occurrence	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Provinces	Important areas along the Ganga River
Sterna acuticauda	Kali tohri, Kalopet panpaira	Indian sub-continent, Laos, Thailand and Cambodia	Endangered	Schedule IV	Upper and Lower Gangetic Plains (7A & 7B)	Bijnor to Narora, Kachhla to Kanpur, Manikpur to Chhhapra, Sahibganj to Farakka



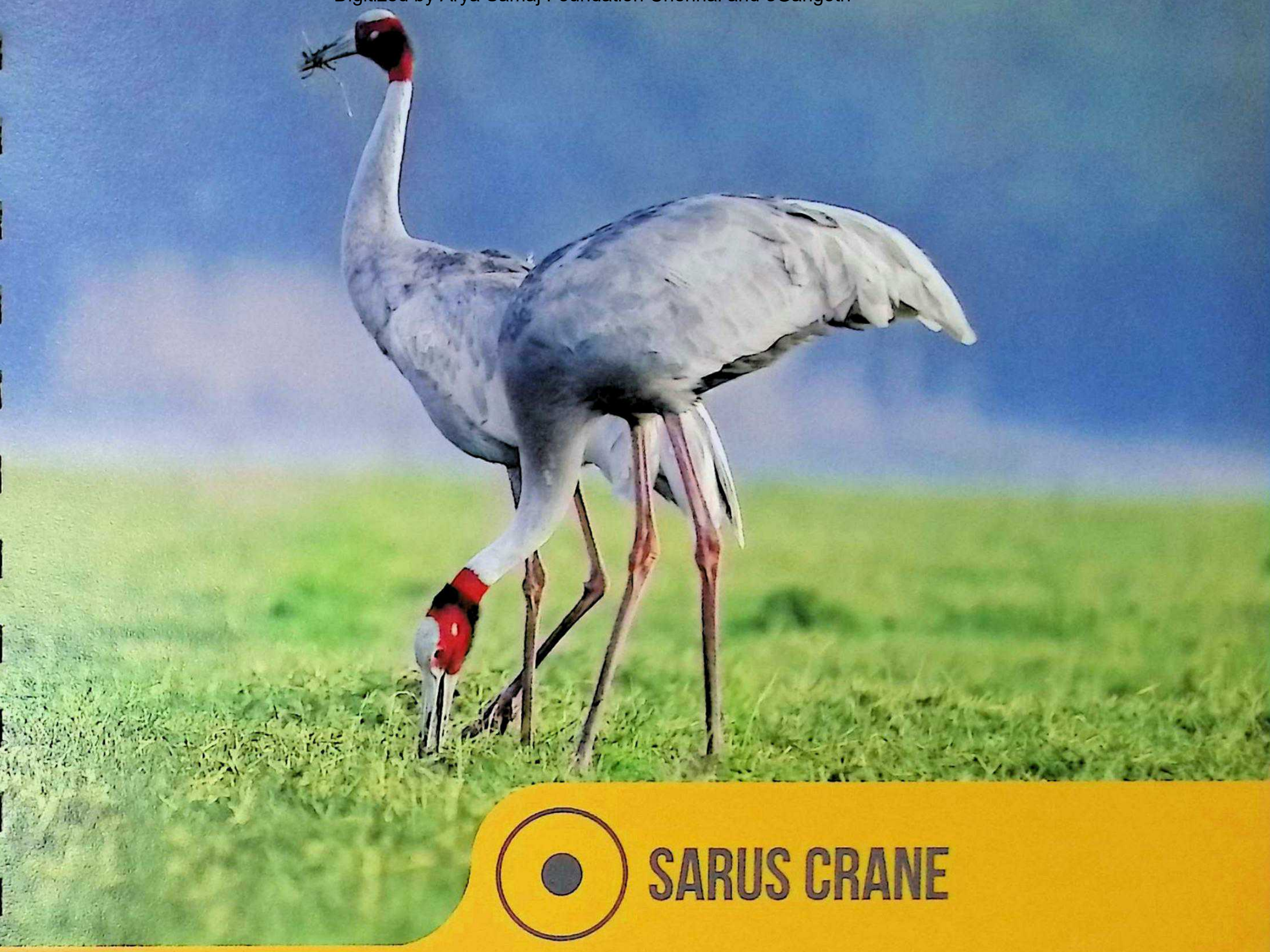
INDIAN SKIMMER

Indian skimmer (*Rynchops albicollis*) occurs in the Indian subcontinent and Vietnam. It is locally extinct from Cambodia, China and Laos. The species is distributed in the middle and lower stretches of the Ganga River. Its preferred habitats are sandy mid-river islands, sandy banks of large rivers and lakes, swamps and coastal wetlands.

The Indian skimmer grows upto 40-43 cm in length. The upper part of the body is black with a white forehead and collar and white underparts. It has a unique long, thick, deep orange bill with yellow tip and a longer lower mandible. Juvenile has dusky orange bill with blackish tip, paler, brownish-grey crown and nape with dark mottling. It breeds during February to May. It is gregarious and a colonial nester, nests on sandy beaches of mid-river islands with a clutch size of 3-4 and occasionally 5. With a characteristic flight it skims over water surface, feeds on surface-dwelling fish, small crustaceans and insect larvae.

The species is threatened by increased human encroachment in riverine and wetland ecosystems, exploitation and degradation of rivers and lakes through fishing, transportation, irrigation and pollution from xenobiotic compounds. An emerging threat for breeding colonies is from sand mining, which has reduced reproductive and foraging success.

Scientific Name	Vernacular Name	Occurrence	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Provinces	Important areas along the Ganga River
Rynchops albicollis	Panchhir, Gang chasha	Indian sub-continent and Vietnam	Endangered	Not listed	Upper and Lower Gangetic Plains (7A & 7B)	Bijnor to Narora, Kachhla to Kanpur, Manikpur to Chhhapra



SARUS CRANE

The Sarus crane (*Antigone antigone*) has three separate populations in the Indian subcontinent, southeast Asia and northern Australia. It is locally extinct from Malaysia, Philippines and Thailand. It is distributed in the middle stretch of the Ganga River and has been extirpated from West Bengal. It occurs in large rivers, natural wetlands, small seasonal marshes, floodplains, fallow and cultivated lands and paddy fields.

The largest Indian crane, it stands at 1.5 m tall and has a bare red head and part of the upper neck, a greyish plumage, greenish horny bill, and red legs. Sexes are alike with females slightly smaller than the males. It breeds during June to September and pairs may indulge in spectacular "dancing" movements, posturing and displays of calling in unison and involve a short series of jumping and bowing movements are made as one of the pair circles around the other. The species nests in agricultural lands, dry grassland with reeds and grasses and nest mounds can reach roughly two meters above the water surface, with a clutch size of 2-3. Sarus is an omnivore predating on invertebrates, small amphibians and snakes exerting a top-down control in the food chain and acts as pest controller. It also feeds on aquatic plants, sedges, grass and seeds, helping in seed dispersal and control of vegetation.

Loss and degradation of wetlands and agricultural drainage of inundated floodplains has pushed these species to human dominated agricultural landscapes leading to increased incidences of conflict. Nest and chick predation by feral animals limits its breeding success. Apart from habitat loss, the persistent xenobiotic compounds also pose a threat to this species.

Scientific Name	Vernacular Name	Occurrence	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Provinces	Important areas along the Ganga River
Antigone antigone	Saras	Indian subcontinent, southeast Asia and northern Australia	Vulnerable	Schedule IV	Upper Gangetic Plain (7A)	Bijnor to Kanpur, Manikpur to Ballia

BIRDS

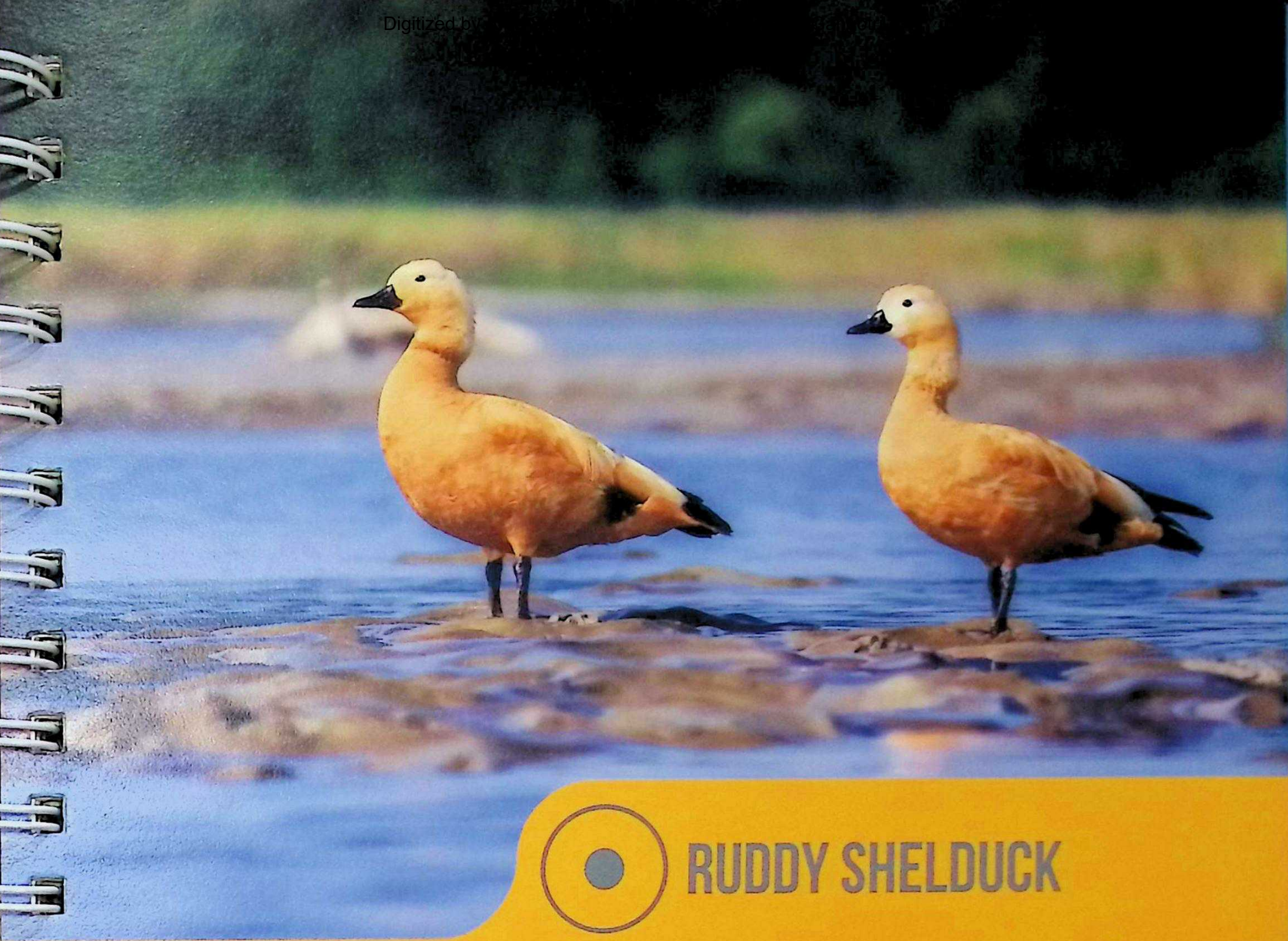
MIGRATORY BIRDS

India falls within the Central Asian Flyway (CAF), utilized by 307 species of migratory waterbirds, most of them coming from Central and North Asia. Of the 307 migratory species, two are Critically Endangered, five are Endangered and 13 species are Vulnerable. Out of remaining 287 species, 10 species are Near Threatened and 277 species are Least Concern as per the IUCN Red List.

The migratory waterbirds, especially waterfowls (ducks and geese) are indicators of ecologically connected ecosystems across their breeding and wintering grounds. They are also indicators of the structural diversity of aquatic vegetation, as well as of overall abundance of benthic and emerging invertebrates. They contribute to ecosystem functioning in rivers and ephemeral wetlands by the spread of plant and animal propagules, as pollinators and also have a significant cultural value. Wetlands of International Importance (Ramsar sites) are declared using criteria based on their importance as habitats for migratory waterbird.

The migratory waterbirds are threatened by change in natural hydrograph in rivers, loss of wetland habitats, poaching and climate change which disrupt migration strategy and breeding success.

During the rapid assessment of waterbird diversity, 87 species of waterbirds and five wetland obligate species belonging to 22 families were recorded from six reservoirs along the Ganga River, viz., Rishikesh, Bhimgoda, Bijnor, Narora, Kanpur and Farakka barrages. Of the total species observed, the members of the Family Anatidae (ducks and geese) dominated (18 species) followed by Scolopacidae (waders) and Ardeidae (egrets and herons).



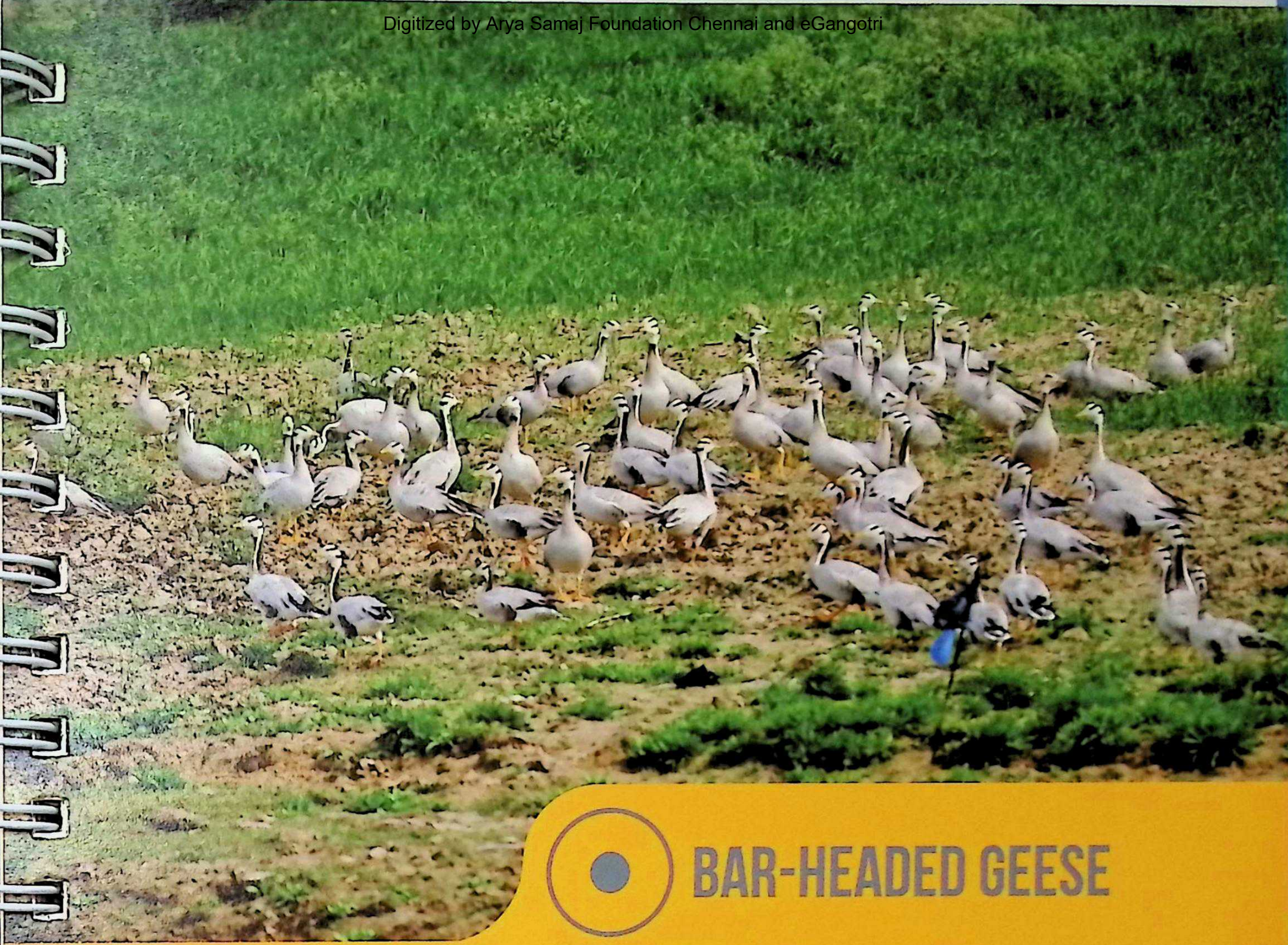
RUDDY SHELDUCK

Ruddy Shelduck (*Tadorna ferruginea*) is widely distributed in Europe, Asia including the Indian subcontinent and Western Africa. The bird is an early winter migrant in India and arrives by October and departs by April. The species is known for its extreme high-altitude flight at 6800 m during migration over the Himalayas. It is distributed in the middle and lower stretches of the Ganga River. The species occurs in inland freshwater and brackish water lakes and rivers. In the non-breeding season, it prefers streams, rivers, freshwater pools, flooded grasslands, and marshes. It avoids coastal waters and tall, dense vegetation or emergent and floating aquatic plants.

The adult birds are 58 to 70 cm in length, male has orange-brown body plumage and a paler, orange-brown head and neck. The inner surfaces of the wings have iridescent green speculum feathers. The bill is black and the legs are dark grey. Females are paler. It breeds during April and early June in high altitude lakes and swamps in Jammu and Kashmir. It nests in a hole or cavity, from ground level upward into trees and cliffs with a clutch size of 6-12. The species is nocturnal, omnivorous and feeds on aquatic and terrestrial invertebrates exercising a top-down control in the food chain. It also feeds on grasses, shoots of plants, grains and water plants helping in seed dispersal and control of vegetation.

The loss and degradation of inland wetlands due to agricultural drainage and wastewater discharge, urban development, xenobiotic compounds, introduction of exotic fish and overgrazing are major issues affecting the species. The species is also susceptible to avian influenza.

Scientific Name	Vernacular Name	Occurrence	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Provinces	Important areas along the Ganga River
Tadorna ferruginea	Surkhab, Chokha chokhi	Europe and Asian countries including Indian Subcontinent and West Africa	Least Concern	Schedule IV	West Himalaya (2B), Upper & Lower Gangetic Plains (7A & 7B)	Throughout the upper and middle stretches of the river upto Barrackpore



BAR-HEADED GEESE

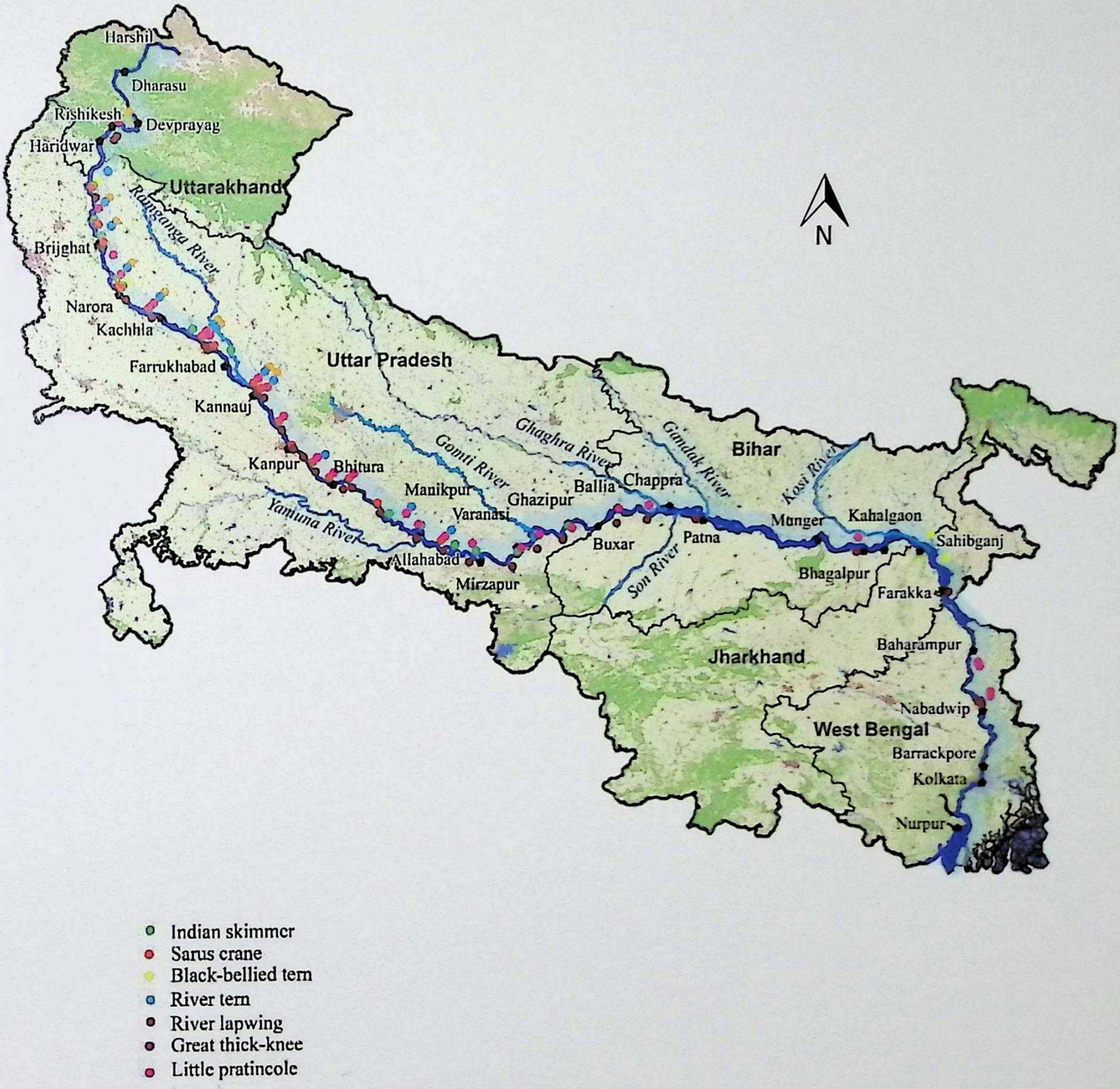
Bar-headed Geese (*Anser indicus*) is distributed in Central Asia including Indian subcontinent, China and Mongolia. It is one of the world's highest flying birds peaking at an altitude of around 6,000 m across the Himalayas during migration. A winter migrant and locally common in India. It occurs in middle and lower stretches of the Ganga River. Mostly occurs in habitat like large rivers, natural wetlands, lakes and freshwater marshes.

The adult birds reach upto 71–76 cm in length. The head and sides of neck of the species is white, with two horizontal black bars, body is generally silver grey and tail is grey with white border. Both the sexes are alike. It breeds during May-June and nests in the marshes and wetlands of the Tibetan Plateau with a clutch size of 2-8. The species is highly gregarious, herbivorous, grazes on grassland and agricultural fields, and on leaves of aquatic plants and sedges. It also feeds occasionally on insect larvae. They play a vital role in maintaining the natural diversity of grasslands by promoting coexistence of different plant species by regulating interspecific competition and by stimulating primary production.

The restricted and patchy breeding grounds of this species make it vulnerable. The timing of arrival on breeding territories and over wintering grounds is a key determinant of reproductive success, survivorship, and fitness. Global climate fluctuations affect adult survival and fecundity. It is also susceptible to avian influenza.

Scientific Name	Vernacular Name	Occurrence	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Provinces	Important areas along the Ganga River
Anser indicus	Hans, Birwa	Central Asia including Indian Subcontinent, China and Mongolia	Least Concern	Schedule IV	Upper and Lower Gangetic Plains (7A & 7B)	Middle stretches until Barrackpore

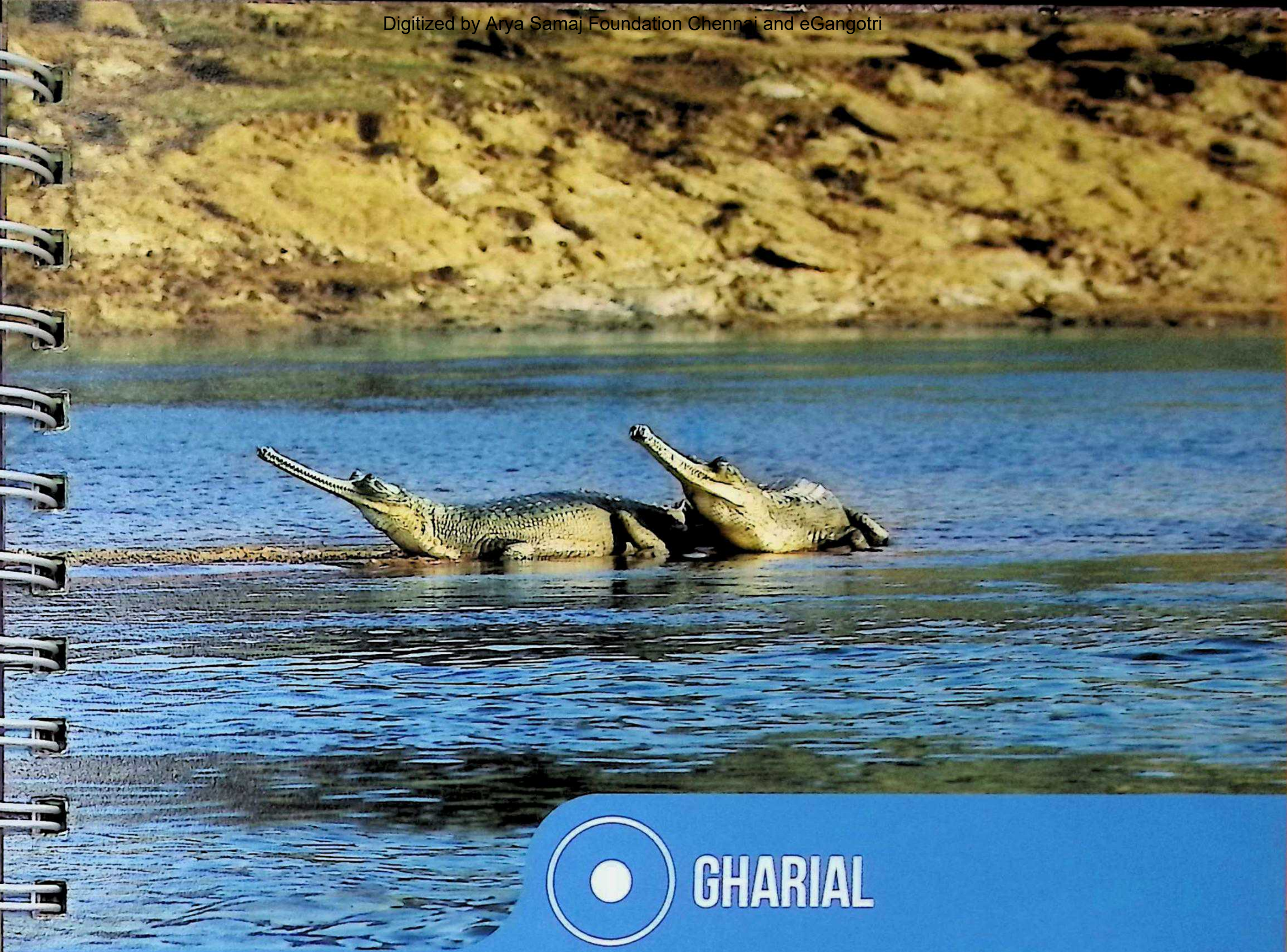
OCCURRENCE OF BIRDS ALONG THE GANGA RIVER


Harshil
Dharasu
Rishikesh
Devprayag
Haridwar
Uttarakhand
Ramganga River
Brijghat
Narora
Kachhla
Farrukhabad
Uttar Pradesh
Kannauj
Kanpur
Bhitura
Manikpur
Gomti River
Ghaghra River
Gandak River
Bihar
Kosi River
Ballia
Chappra
Ghazipur
Varanasi
Yamuna River
Allahabad
Mirzapur
Buxar
Patna
Son River
Munger
Kahalgaon
Sahibganj
Bhagalpur
Farakka
Jharkhand
Baharampur
Nabadwip
West Bengal
Barrackpore
Kolkata
Nurpur
N
● Indian skimmer
● Sarus crane
● Black-bellied tern
● River tern
● River lapwing
● Great thick-knee
● Little pratincole

CROCODILIANS

Crocodilians belong to the Class Reptilia and Order Crocodylia. Their senses of sight, smell and hearing are well developed. Their eyes are at the top of their head, close together to allow for binocular vision. The nostrils are crescent-shaped and valvular, and set at the end of the snout, which allows breathing even when the animal is almost entirely submerged. Their ears are covered by flaps, which close to prevent water from entering them. Their front feet have five separate toes and their rear feet have four partially-webbed toes. Crocodilians are adapted for a semi-aquatic life, are poikilothermic and temperate species. They bask in the sun during the day to raise their body temperature, returning to the water to cool off. Globally, they are represented by 24 extant species. In India, *Crocodylus palustris* (Mugger or marsh crocodile) and *C. porosus* (Estuarine crocodile) represent Crocodylidae family and the *Gavialis gangeticus* (Gharial) is the only surviving member of the Gavialidae family. These species are distributed in the Ganga River and its major tributaries.

CROCODILIANS
TURTLES
AMPHIBIANS
FISH



GHARIAL

The Gharial is endemic to the Indian subcontinent, occurring in the Indus, Ganga, Brahmaputra and the Mahanadi river systems. The gharial is now extinct in Myanmar, Bhutan and Pakistan. Male gharials can grow up to 6.5 m, while females are smaller. The snout is long and slender, specialized for catching fish. Males have a bulbous growth at the end of their snout called a "ghara". It functions during courtship as a visual stimulus for females, and allows gharials to produce a loud buzzing sound. They are equipped with extensively webbed feet for locomotion in the water. It is a hole-nesting species and nests along rivers in undisturbed sandy banks and islands. They prefer sandy banks with water depth of more than 4 m. Its clutch size varies from 20-60 eggs and the incubation period is around 65 days.

The species was on the verge of extinction in India by the mid-1970's until a captive breeding programme was initiated during 1975 and the population was made secure in the wild by 1995 with around 1200 gharials. However, since 1999 the gharial population has shown a dramatic decline throughout its entire range, largely as a result of anthropogenic pressures such as mortalities in fishing nets, reduction in water flow, and encroachment on river banks for agriculture, sand mining, construction of dams and barrages.

The species is a top predator and prefers to eat slower-moving, large predatory fish, such as catfish. Ecologically, disappearance of gharial from an ecosystem signifies a collapsed ecosystem due to polluted waters and or drastic drop in water levels. Gharials are hunted for use of its body parts in indigenous medicine and its eggs are harvested for consumption. During the rapid assessment, gharial presence was recorded downstream of the Bhimgoda barrage, between Bijnor and Brijghat.

Scientific Name	Vernacular Name	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Province	Important areas along the Ganga River
Gavialis gangeticus	**Gharial**	**Critically Endangered**	**Schedule I**	**Upper and Middle Gangetic Plain (7A & 7B)**	**Downstream of Bhimgoda barrage, Hastinapur Wildlife Sanctuary, Bijnor to Brijghat**

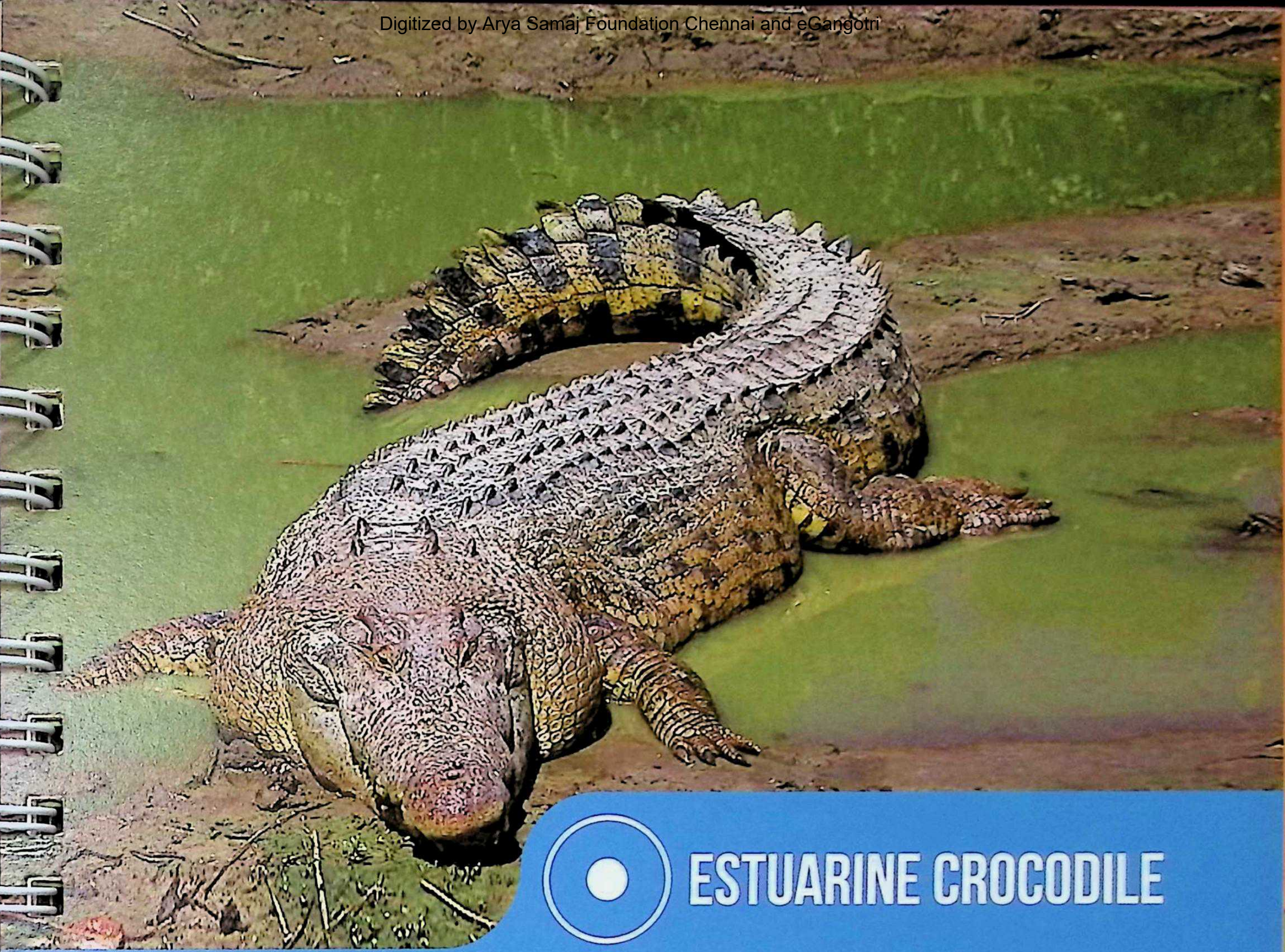
MUGGER

The Mugger is a wide-ranging species, found in India, Sri Lanka, Pakistan, Nepal and possibly Bangladesh, extending westwards into eastern Iran. The species has become locally extinct over large parts of its range, and viable populations occur mostly within Protected Areas. In India, the species has been reported in 15 states and throughout much of the Ganga drainage. Significant populations occur in the Middle Ganga (Bihar and Jharkand), Chambal River (Rajastan and Madhya Pradesh) and in Gujarat.

Muggers are medium to large crocodiles, reaching 4 to 5 m in length. They have an elongate, robust skull and jaw musculature and have the broadest snout of all crocodilians. It is a hole-nesting species and nests along rivers, lakes and similar water bodies. Its clutch size varies from 20-40 eggs and the incubation period is around 62 days. They are hunted for their skin for manufacture of shoes, handbags, and other items.

Muggers have a highly adaptable nature and are known to survive in stagnant waters with placid current, making it also the most widely distributed species. They are opportunistic predators and prefer fish, amphibians, reptiles mainly snakes and possibly turtles, birds and small mammals. They also feed on carrion. The species is poached for its skin and meat as well as for its use in medicine. Mugger eggs are also poached for consumption by humans. During the rapid biodiversity assessment, muggers were sighted near Bijnor, at Malda, and upstream of the Farakka barrage. Muggers are at the apex of food web and perform the ecological role of both predators and scavengers.

Scientific Name	Vernacular Name	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Provinces	Important areas along the Ganga River
Crocodylus palustris	Mugger	Vulnerable	Schedule I	Upper & Lower Gangetic Plains (7A & 7B)	Hastinapur Wildlife Sanctuary, Bijnor to Brijghat, Malda and upstream of Farakka



ESTUARINE CROCODILE

Estuarine or Saltwater crocodiles are most commonly found along the east coasts of India to northern Australia, through Southeast Asia along the islands of New Guinea and Indonesia. They are found in the brackish water areas of estuaries and rarely venture into the sea. They are strong swimmers and have a high tolerance for salinity.

Adult males can reach up to 6 to 7 m in length, while females do not generally exceed 3 m. The head is very large and a pair of ridges run from the eyes along the center of the snout. This crocodile spends most of its time thermogulating to maintain its body temperature. If they become too hot they often go into the water with only their eyes and nostrils showing and stay submerged until they are cooled. They are mound nesters; they create mounds of mangrove plants and mud and nest on it. Its clutch size varies from 20-60 eggs and the incubation period is around 72 days.

Estuarine crocodiles are rare in India and smaller populations occur throughout the Sundarbans at the mouth of the Ganga River. Apart from Sundarbans, the largest population of this crocodile is found in the Bhitarkanika National Park in Odisha.

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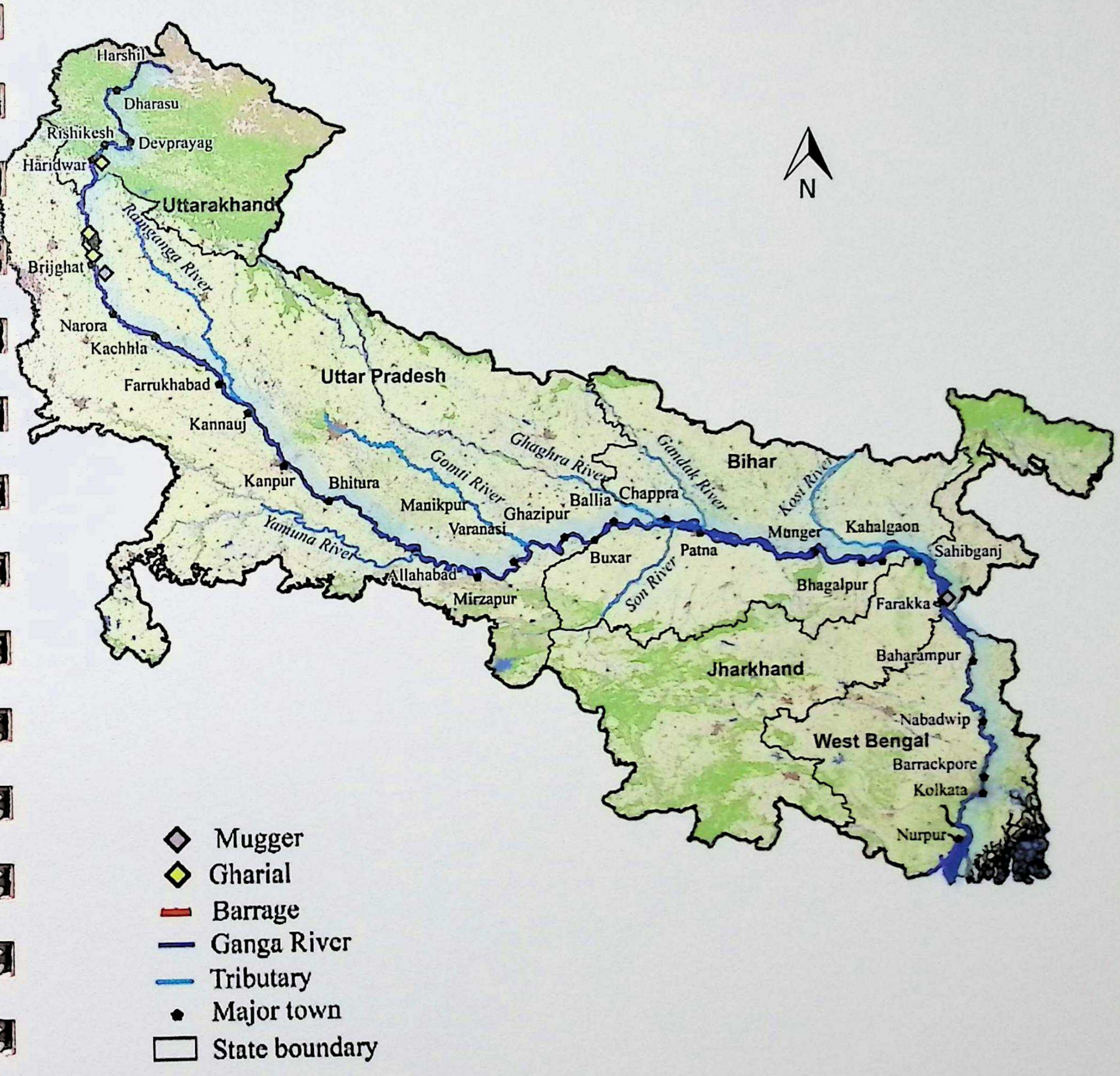
Scientific Name	Vernacular Name	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Province	Important areas along the Ganga River
Crocodylus porosus	Kumhir, Kumbhira	Least Concern	Schedule I	East Coast (8B)	Mouth of the Ganga River

OCCURRENCE OF CROCODILIANS ALONG THE GANGA RIVER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Dharasu
Rishikesh
Devprayag
Haridwar
Uttarakhand
Ramganga River
Brijghat
Narora
Kachhla
Farrukhabad
Kannauj
Uttar Pradesh
Kanpur
Bhitura
Gomti River
Manikpur
Ghazipur
Varanasi
Yamuna River
Allahabad
Mirzapur
Ghaghra River
Ballia
Chappra
Gandak River
Bihar
Buxar
Patna
Son River
Kosi River
Munger
Kahalgaon
Bhagalpur
Sahibganj
Farakka
Jharkhand
Baharampur
Nabadwip
West Bengal
Barrackpore
Kolkata
Nurpur
◇ Mugger
◆ Gharial
▬ Barrage
▬ Ganga River
▬ Tributary
● Major town
☐ State boundary

TURTLES

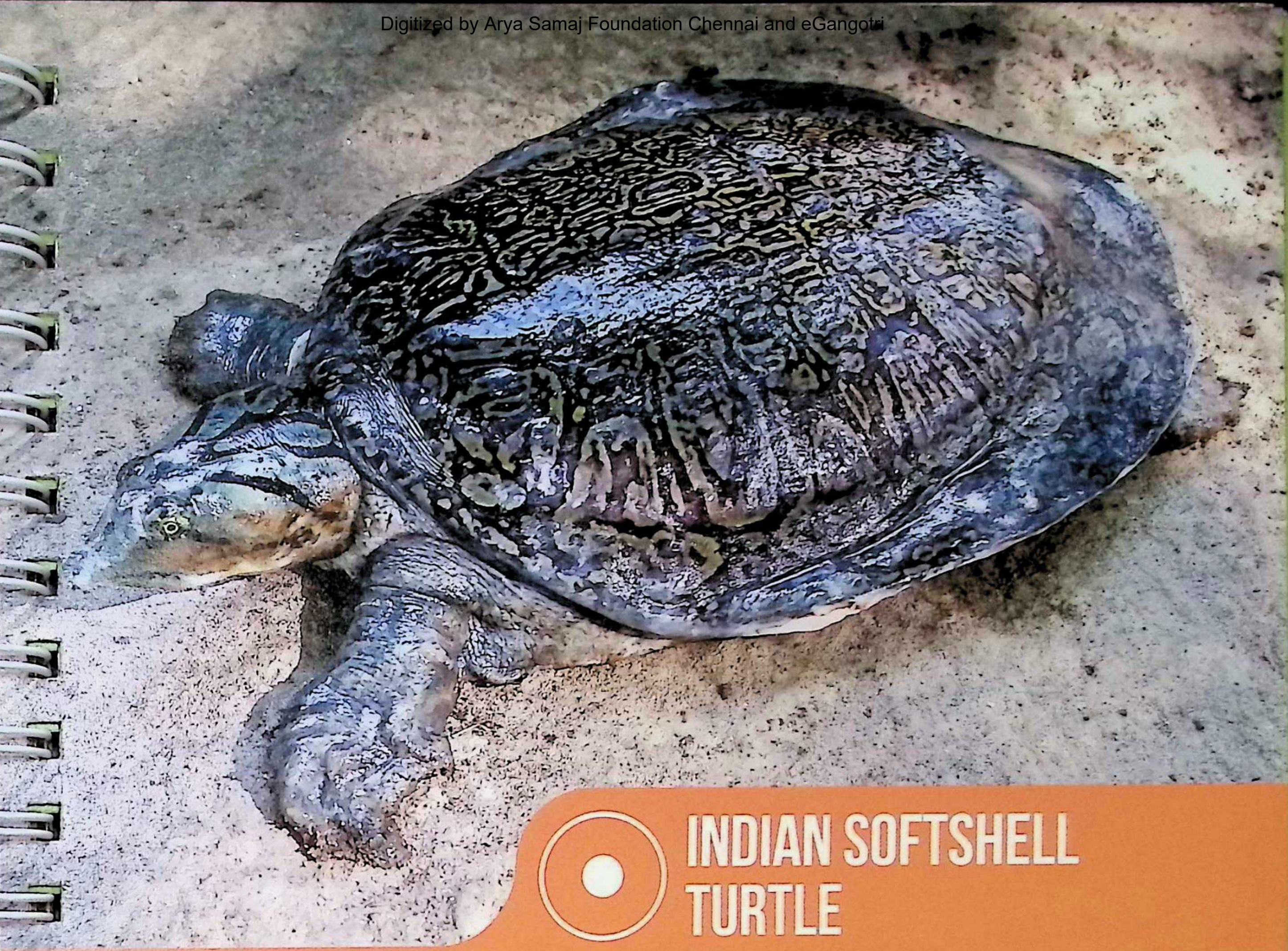
India is one of the global hotspot for freshwater turtle diversity harbouring 24 species of turtles and ranks among the top five countriesin the world for turtle conservation. The Ganga River is home to at least 13 of these species. According to their physiological and adaptive features, they occur from the upper stretches of the Ganga River till the Sundarban delta, covering the Himalayas, Gangetic Plains and Coasts.These freshwater turtles are represented by nine hardshell and four softshell species belonging to Class Reptilia, Order Testudines and families Geoemydidae and Trionychidae, respectively.

The hardshell species have a unique epidermal and skeletal structure in the form of a dome-shaped shell which is covered by horny scutes formed of its epidermis. These scutes overlap the seams between the shell bones and add strength to the shell. The softshell turtles lack these scutes on the flattened shell, which is covered with soft skin. They have boomerang-shaped entoplastron and possess long extensible necks, fleshy lips, tubular snout and three-clawed fore and hind limbs. These turtles are highly aquatic, drought resistant, carnivorous and even show necrophagy.

The freshwater turtles are exclusively aquatic. However, they need undisturbed terrestrial habitats like sand banks, bars, mid-river islands for nesting and basking. These species are ectothermic and bask in the sun in groups to regulate body temperature. They use a designated 'communal ground' in a sand bank/bar/island for nesting and hatchlings emerge on their own during pre and post-monsoon.

These turtles play a significant role in the river by scavenging dead organic material and diseased fish, controlling fish population as predators and controlling aquatic plants and weeds. They are also indicators of healthy aquatic ecosystems.

Most of the freshwater turtle populations are declining in the Ganga River due to sand mining which degrade the nesting habitat, illegal poaching and trade which deplete the source population, accidental mortalities in fishing nets, xenobotic compounds from agricultural fields and industries which cause toxic impact, and altered natural flow regime by dams and barrages which cause nest inundation or desiccation. It is also likely that modification of river morphology for navigation such as dredging and concretization of banks may destroy freshwater turtle habitats.



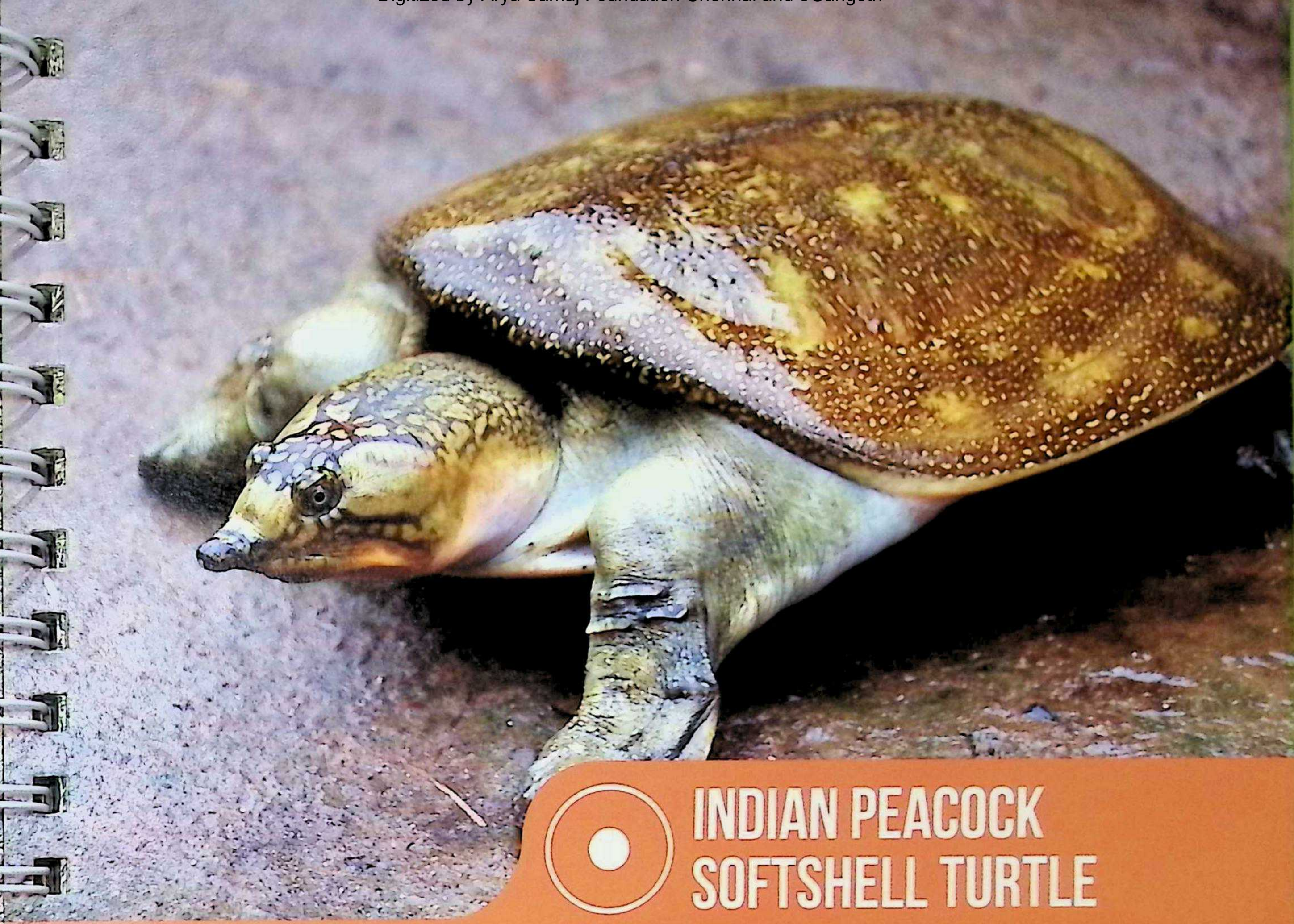
INDIAN SOFTSHELL TURTLE

Indian softshell turtle (*Nilssonia gangetica*) occurs in the Ganga, Indus and Mahanadi river systems in India. It is found in the middle and lower stretches of the Ganga River.

Its olive coloured body is dorsally flattened, head has a black longitudinal streak from between the eyes to the nape, and snout is tube-like. It reaches a carapace length of up to 94 cm.

The species inhabits deep rivers, streams, and large canals, lakes and ponds with mud and sand bottoms. It breeds during August and November andnests in islands and clayey river banks with a clutch size of 8-47. Eggs hatch during July. It is a predatory species, which also feeds on carcass. It controls fish population, removes diseased fish from rivers and also maintains water quality by scavenging on decaying organic material. The species is highly exploited for calipee, meat, eggs and illegal trade.

Scientific Name	Vernacular Name	Occurrence	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Provinces	Important areas along the Ganga River
Nilssonia gangetica	Patal, Ganga kachhim	Ganga, Indus and Mahanadi river systems	Vulnerable	Schedule I	Upper & Lower Gangetic Plains (7A & 7B)	Bijnor to Narora, Kannauj to Kanpur, Allahabad to Varanasi



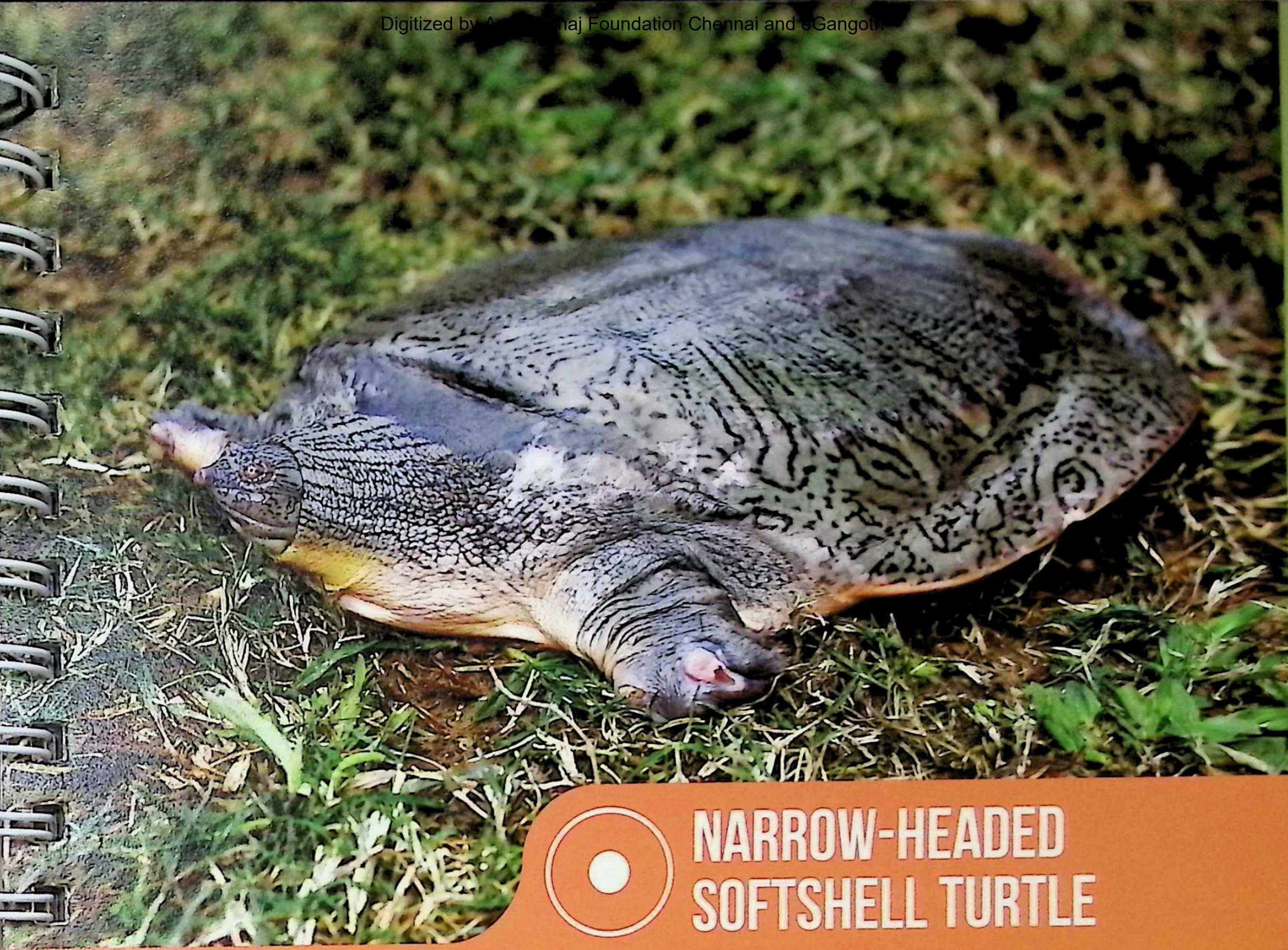
INDIAN PEACOCK SOFTSHELL TURTLE

Indian peacock softshell turtle (*Nilssonia hurum*) occurs in the rivers of India, Bangladesh, Nepal and Pakistan. In the Ganga River, the species occurs in the middle and lower stretches.

The species has a large head, dark olive green to nearly black oval carapace and downturned snout. It reaches a carapace length of 60 cm.

It inhabits rivers, streams, lakes and ponds with mud or sand bottoms. It breeds during August to November. N. hurum nests in islands and silty river banks with a clutch size of 20–30. Eggs hatch during June-July. The species is omnivorous and a carrion feeder. It controls fish population and maintains the water quality by scavenging on carcass and detritus. The species is exploited for meat, eggs and in illegal trade.

Scientific Name	Vernacular Name	Occurrence	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Provinces	Important areas along the Ganga River
Nilssonia hurum	**Kathawa, Dhum kachhim**	**Ganga and Indus river systems**	**Vulnerable**	**Schedule I**	**Upper & Lower Gangetic Plains (7A & 7B)**	**Bijnor to Narora, Kannauj to Kanpur, Allahabad to Varanasi, Baharampur to Barrackpore**



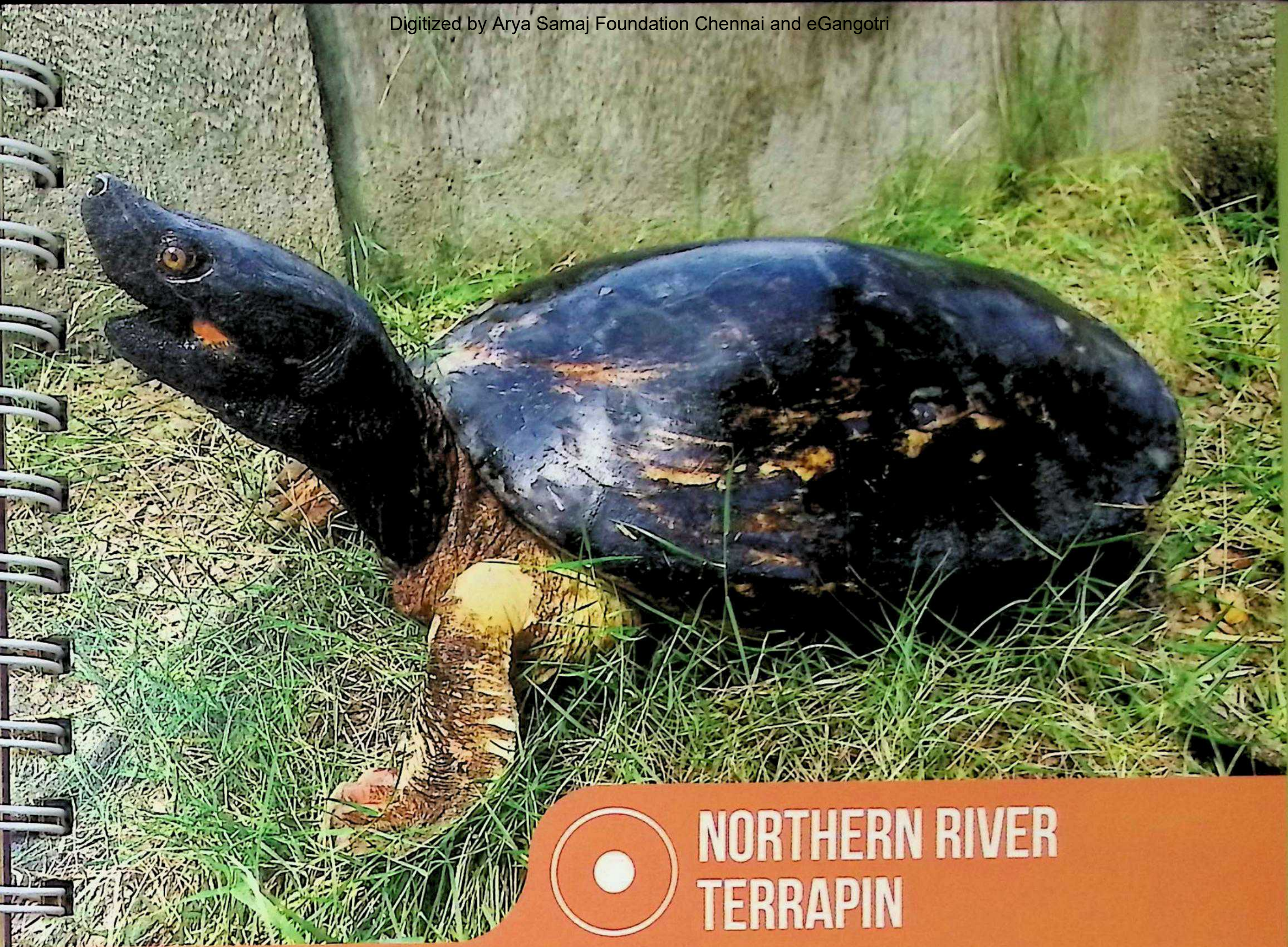
NARROW-HEADED SOFTSHELL TURTLE

Narrow-headed softshell turtle (*Chitra indica*) occurs in the rivers of India, Pakistan, Nepal, Bangladesh, Myanmar and western Malaysia. In India, the species occurs in the middle and lower stretches of the Ganga River, and the Indus, Godavari, Coleroon and Mahanadi river systems.

It has a small head, rounded snout, eyes close to nostrils and an olive-green body. The species is very large and attains a carapace length of 1.1 m.

It breeds during June to August in central India. It nests in river islands and sandy river banks with a clutch size of 65-193.Eggs hatch during September-October. *C. indica* is highly aquatic, ambush hunter and stays concealed below the sand-vegetation, with only the tip of the snout exposed. As an apex predator, it controls fish, amphibian and zoobenthos population. The species is overly exploited for calipee, meat and eggs.

Scientific Name	Vernacular Name	Occurrence	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Provinces	Important areas along the Ganga River
Chitra indica	Chitra	Ganga, Indus, Godavari and Mahanadi river systems	Vulnerable	Schedule IV	Upper & Lower Gangetic Plains (7A & 7B)	Bijnor to Narora, Kannauj to Kanpur, Allahabad to Varanasi



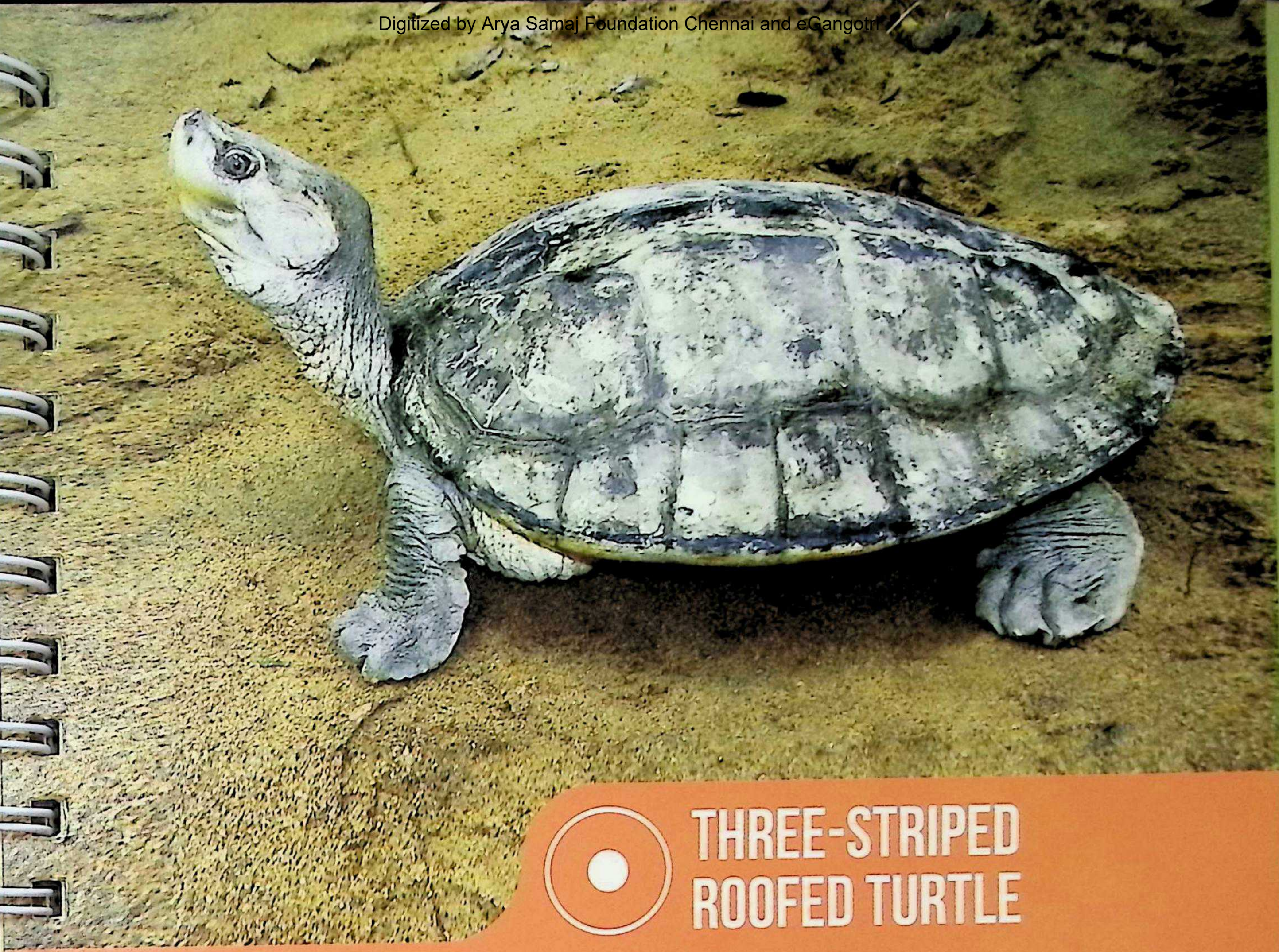
NORTHERN RIVER TERRAPIN

Northern river terrapin (*Batagur baska*) a hardshell turtle is distributed in India, Bangladesh, Cambodia, Indonesia and Malaysia. The species is extinct from the former ranges such as Myanmar; Singapore, Thailand, Vietnam and almost extirpated from the Hooghly River stretch in the Lower Ganga. It is a conservation dependent species as very few are left in the coastal mangrove estuaries in the Sundarbans.

The carapace is smooth and grey or black, has an upturned snout and attains a length upto 60 cm. It is a sexually dimorphic species and the male show breeding colouration - black head, crimson body and forelegs.

It lives in coastal mangrove estuaries and creeks, but ventures far upstream during the breeding season. Females dig nests in sandbars and banks far upstream from the normal estuarine habitat during the breeding season from December to March. It is omnivorous, controls aquatic weeds and maintains aquatic plant population in mangrove swamps.

Scientific Name	Vernacular Name	Occurrence	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Province	Important areas along the Ganga River
Batagur baska	Pora katha	Coastal mangrove estuaries in the Sundarbans	Critically Endangered	Schedule I	East Coast (8B)	Downstream of Farakka Barrage till Ganga Sagar



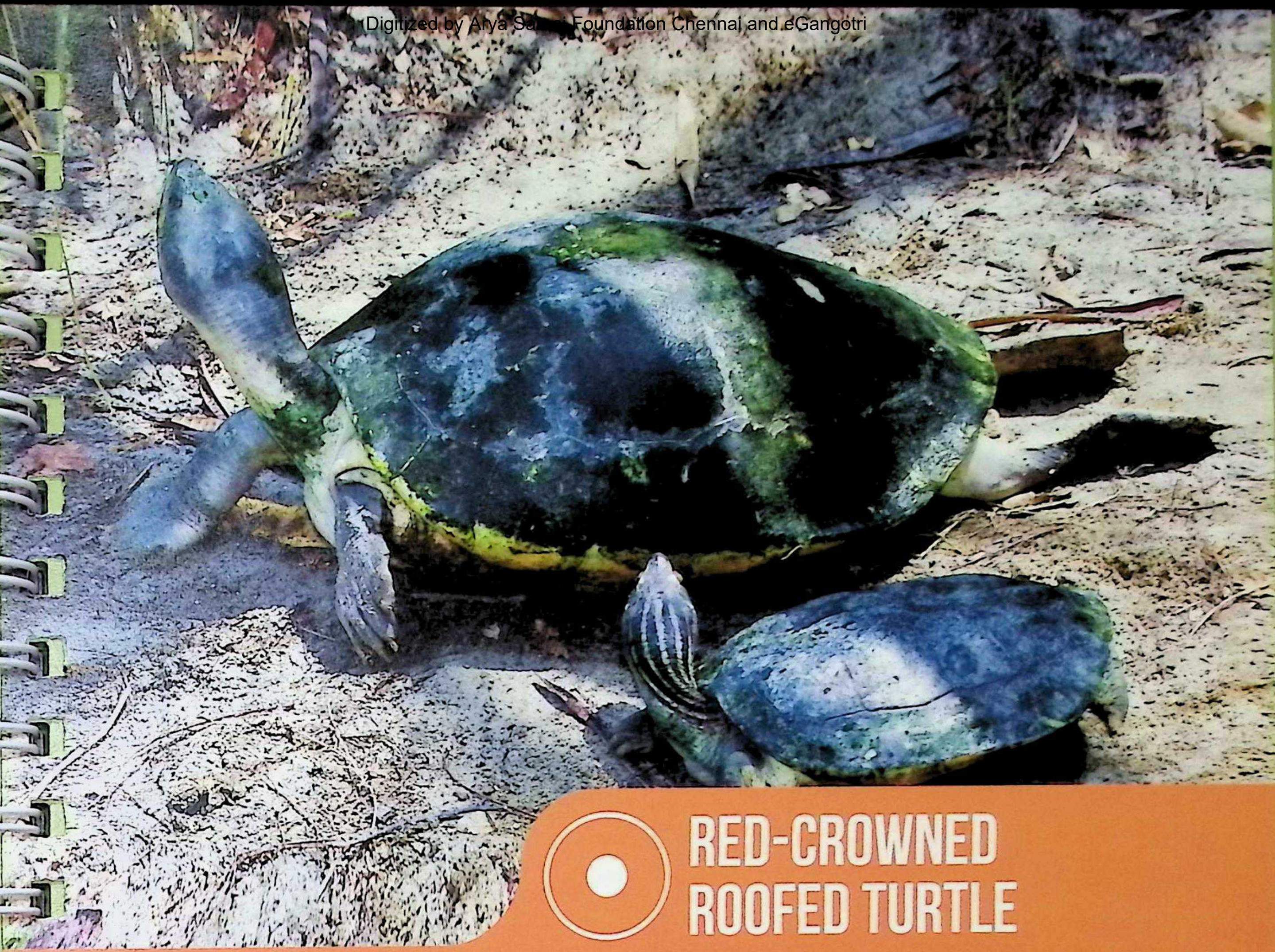
THREE-STRIPED ROOFED TURTLE

Three-striped roofed turtle (*Batagur dhongoka*) is a hardshell species and occurs in India and Bangladesh. It occurs in the middle and lower stretches of the Ganga River.

The species has an oval and elevated carapace, dorsally brownish-grey with three dark brown stripes; yellow stripe on head and neck from tip of snout and over eyes. It attains a carapace length up to 60 cm.

The species inhabits large rivers with sandy banks and breeds during March and April. Nests with a clutch size of 26 are laid on sandy banks/islands. Eggs hatch during June. *B. dhongoka* is herbivorous, controls invasive aquatic weeds and maintains aquatic plant population.

Scientific Name	Vernacular Name	Occurrence	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Provinces	Important areas along the Ganga River
Batagur dhongoka	Dhor, Sadakatha	Ganga, Brahmaputra and Padma river systems	Endangered	Schedule I	Upper & Lower Gangetic Plains (7A & 7B)	Bijnor to Narora, Kannauj, Allahabad to Varanasi



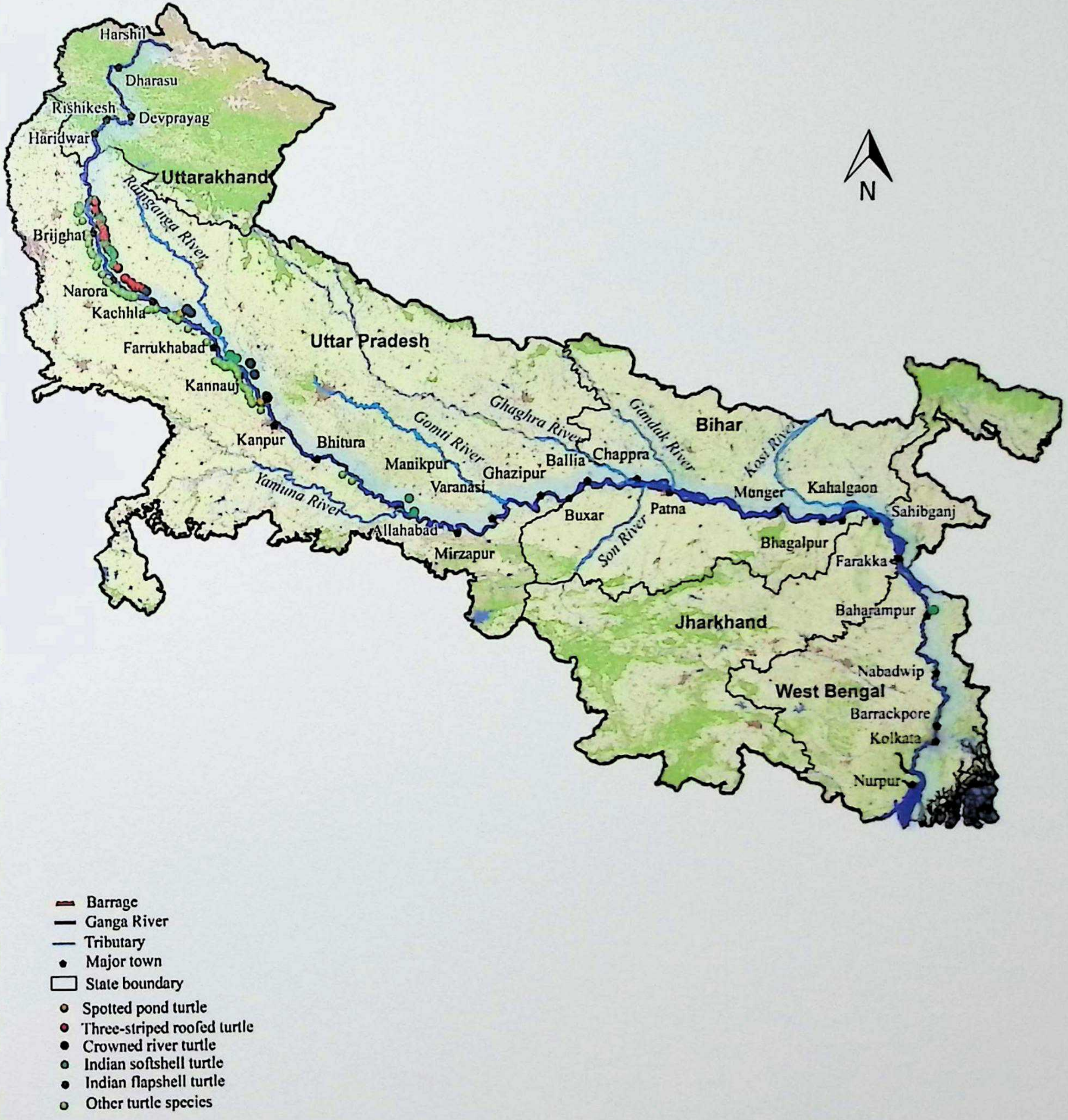
RED-CROWNED ROOFED TURTLE

Red-crowned roofed turtle (*Batagur kachuga*) a hardshell species occurs in India, Nepal and Bangladesh. In the Ganga River, it is distributed in the middle and lower stretches. The species has a dome-shaped pale green-grey carapace, the limbs have transversely enlarged and nape has red longitudinal lines. Males reach only half the length of females which has a carapace length of up to 56 cm. It is sexually dimorphic and the males show breeding colouration - red crown and yellow and blue stripes from head to neck.

It is exclusively freshwater, inhabiting deep flowing rivers with sandy nesting sites. It is a herbivorous species, and controls invasive aquatic weeds and maintains aquatic plant population. The species is overexploited for its meat, eggs and in pet trade.

Scientific Name	Vernacular Name	Occurrence	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Provinces	Important areas along the Ganga River
Batagur kachuga	Sal, Adikori katha	Ganga, Indus and Mahanadi river systems	Critically Endangered	Schedule I	Upper & Lower Gangetic Plains (7A & 7B)	Bijnor to Narora, Kannauj, Allahabad to Varanasi, Farakka to Barrackpore

OCCURRENCE OF TURTLES ALONG THE GANGA RIVER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Uttar Pradesh
Kannauj
Kanpur
Bhitura
Gomti River
Ghaghra River
Gandak River
Bihar
Kosi River
Manikpur
Ghazipur
Ballia
Chappra
Varanasi
Yamuna River
Allahabad
Mirzapur
Buxar
Patna
Son River
Munger
Kahalgaon
Sahibganj
Bhagalpur
Farakka
Jharkhand
Baharampur
Nabadwip
West Bengal
Barrackpore
Kolkata
Nurpur
Barrage
Ganga River
Tributary
Major town
State boundary
Spotted pond turtle
Three-striped roofed turtle
Crowned river turtle
Indian softshell turtle
Indian flapshell turtle
Other turtle species

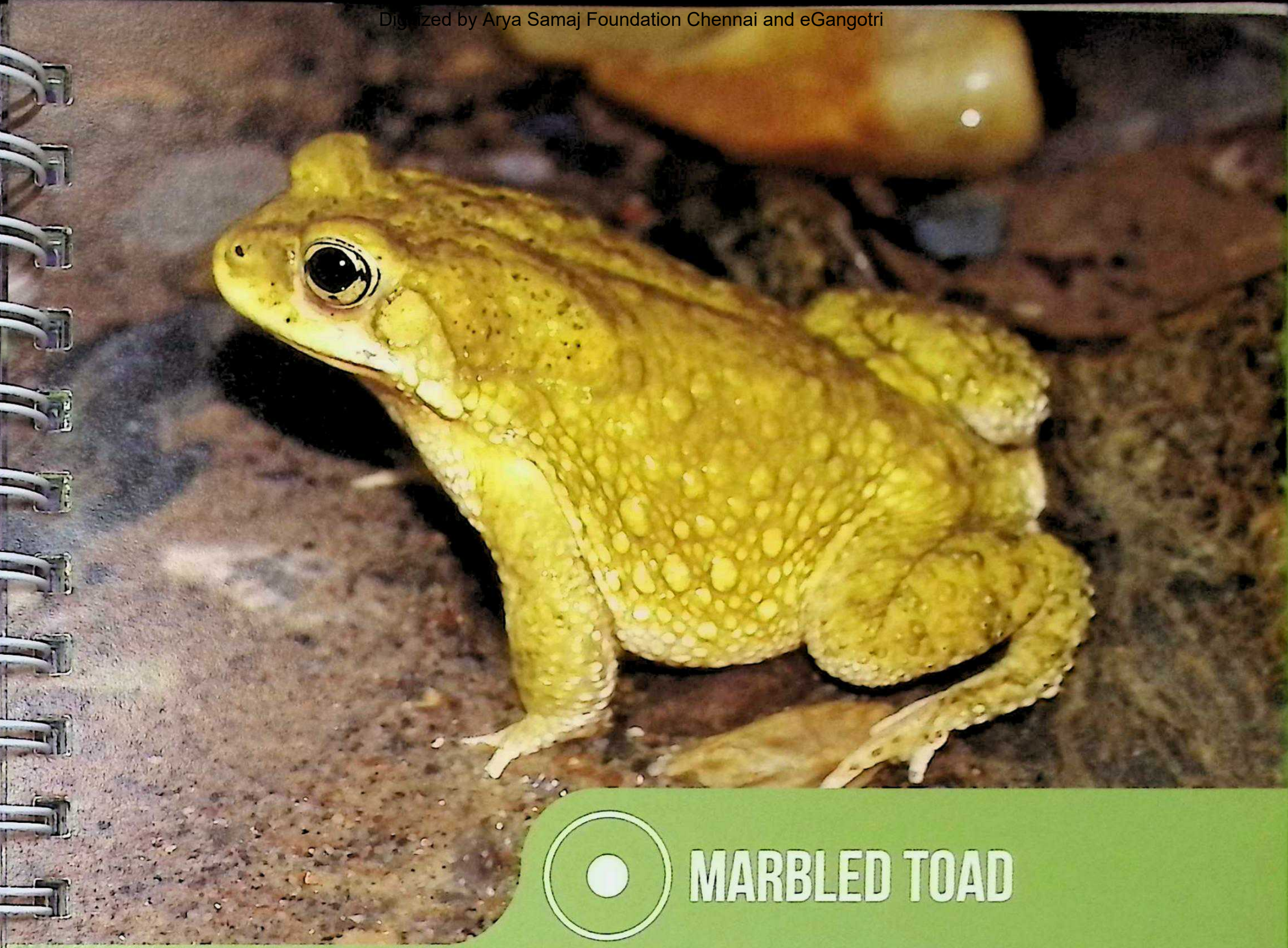
AMPHIBIANS

Amphibians are a distinctive group of vertebrates with unique physiological adaptations, particularly for semi-aquatic and aquatic habitats. Some are also specialized to live in trees or in deserts. There are approximately 7,000 known amphibian species of which nearly 90% are frogs. India harbors 384 species of amphibians, of which 167 species (66.3%) are endemic and distributed mostly in the Western Ghats and North-east.

The Ganga River basin provide habitat for about 49 amphibian species. These species are distributed from 3,000 m asl to the plains and delta.

Amphibians have a unique dual lifecycle, where the first phase is primarily dependent upon freshwater habitats. Typically, the eggs are laid in water or moist conditions. The larvae grow in water bodies and metamorphose into adult which utilize both terrestrial and aquatic habitats. Amphibians most of the time respire through their extremely thin skin which is called 'cutaneous gas exchange' and in the process can bypass their lungs completely. This characteristic feature, along with dependence upon freshwater ecosystems make these species acutely sensitive even to slight changes in temperature, humidity, air or water quality and susceptible to fungal diseases. These species are considered as the most sensitive to climate change.

Amphibians play a pivotal role in both aquatic and terrestrial ecosystem as secondary consumers in many food chains. Adult amphibians also act as one of the best biological pest controllers. From the ecological perspective, amphibians are regarded as good environmental indicators as their responses have been used to indicate habitat fragmentation, impact of xenobiotic compounds and overall ecosystem stress. Most of these less studied species are declining throughout their distribution range because of the changes in localized temperature and rainfall patterns, habitat loss, overutilization and diseases. The synergistic effects threaten almost 48% of the already rapidly declining species and are driving several species towards extinction.



MARBLED TOAD

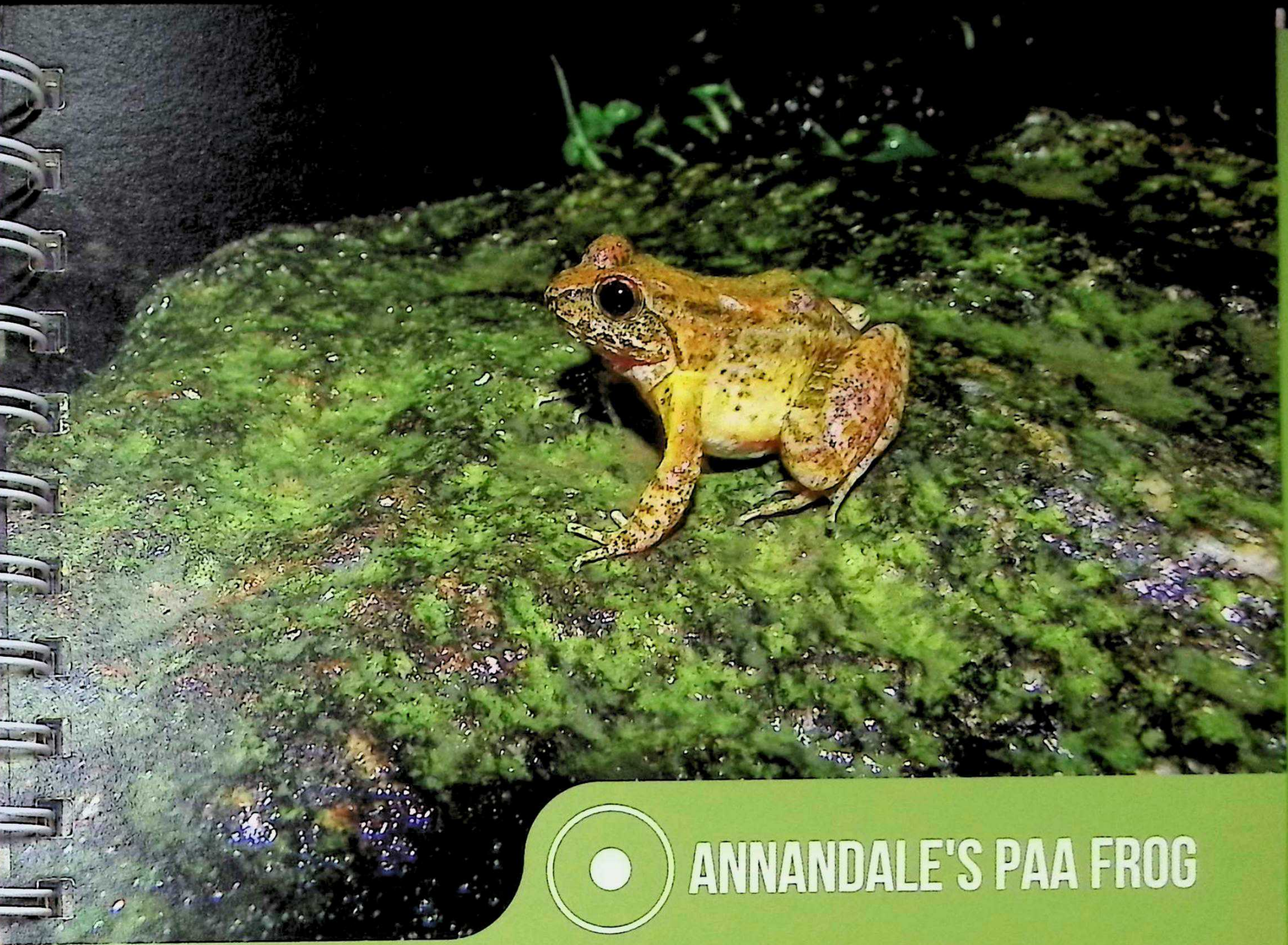
Marbled toad (*Duttaphrynus stomaticus*) is widely distributed in Afghanistan, Iran, Pakistan, Nepal, Bangladesh and India. The upper elevation limit of this species is 4500 m. It is widely distributed throughout India. In the context of the Ganga River, the species has been recorded from the upper stretch covering Uttarkashi, Tehri, Pauri, Garhwal-Srinagar and Rishikesh; all through the Gangetic plains in the middle stretch and; from Calcutta and southern West Bengal in the lower stretch.

It is a light brown, moderately large bodied toad with a size of 76 mm. Tympanum is distinct, first finger longer than the second. The skin may be smooth with a few flattened tubercles. Male has a subgular vocal sac. During the breeding season, the skin color changes to yellow in both the sexes, with the males brighter than the females.

The species inhabits a wide variety of habitats such as open plains, grasslands, scrubland, forest, agricultural land and human habitations. It is a highly adaptable species and can survive under varying climatic conditions. Breeding occurs in permanent and seasonal pools, seasonal streams and slow-flowing streams.

The species is vulnerable to loss of habitat due to infrastructure development, agricultural intensification, pollution of wetlands and land by agrochemicals, traffic related mortality, and droughts.

Scientific Name	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Provinces
Duttaphrynus stomaticus	**Least Concern**	**Not listed**	**Upper & Lower Gangetic Plains (7A & 7B)**



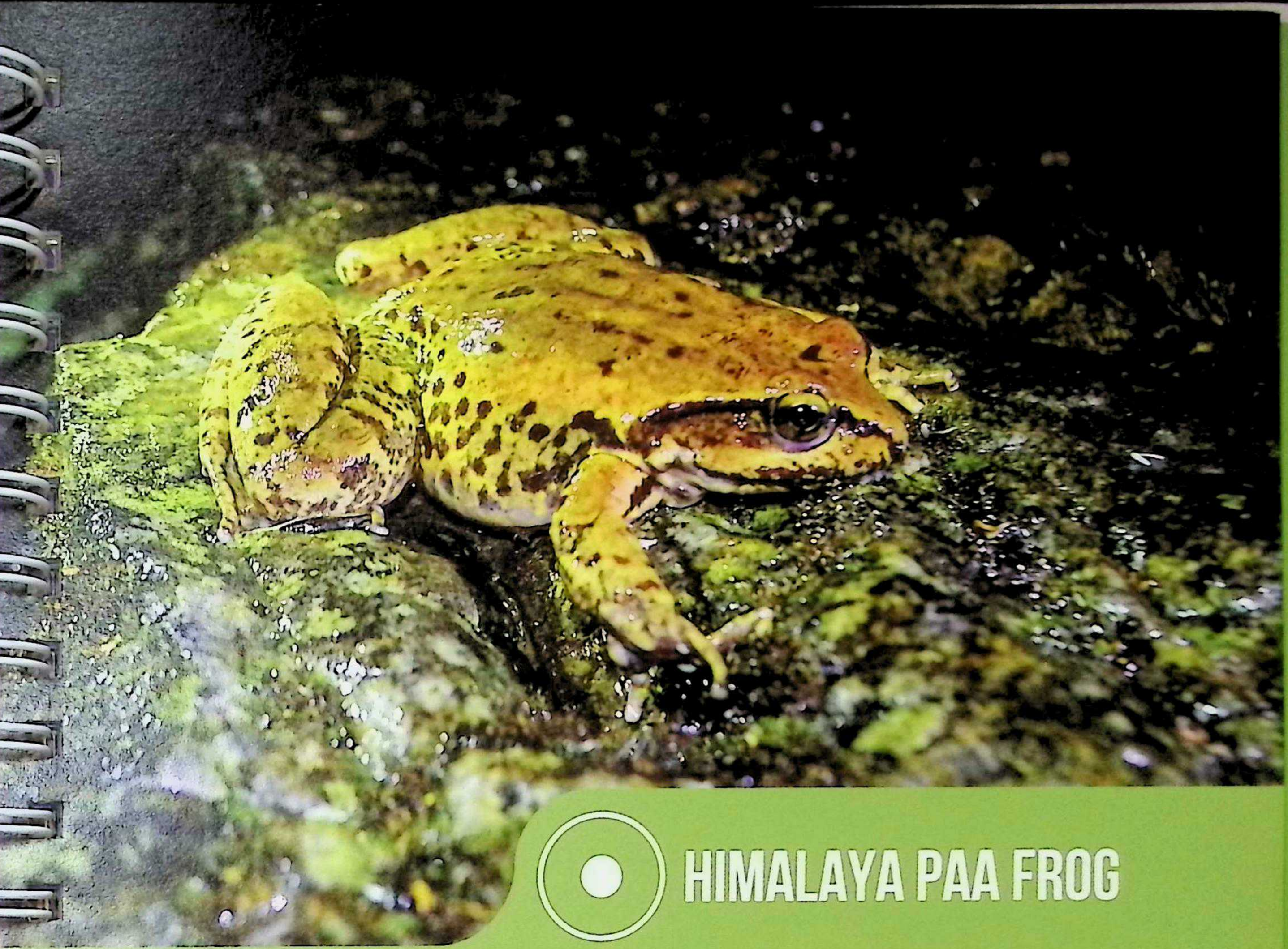
ANNANDALE'S PAA FROG

Annandale's Paa Frog (*Nanorana annandalii*) has been reported from India, Nepal and Bhutan. In India, it is found in Arunachal Pradesh, Sikkim, Uttarakhand and north eastern part of West Bengal, between 1500-3000 m asl. The species has been reported from the upper stretch of the Ganga River.

It is a medium sized frog of 55 mm. Body is olive in colour with marbling and the belly is white. It inhabits rocky streams and brooks in montane forests, and with pools in forest clearings. It needs moderate temperatures and high humidity. The tadpoles develop in streams.

Currently the population of the species is declining due to habitat fragmentation, stream modification, localized deforestation and dam construction.

Scientific Name	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Province
Nanorana annandalii	**Near Threatened**	**Not listed**	**Lower Gangetic Plain (7B)**



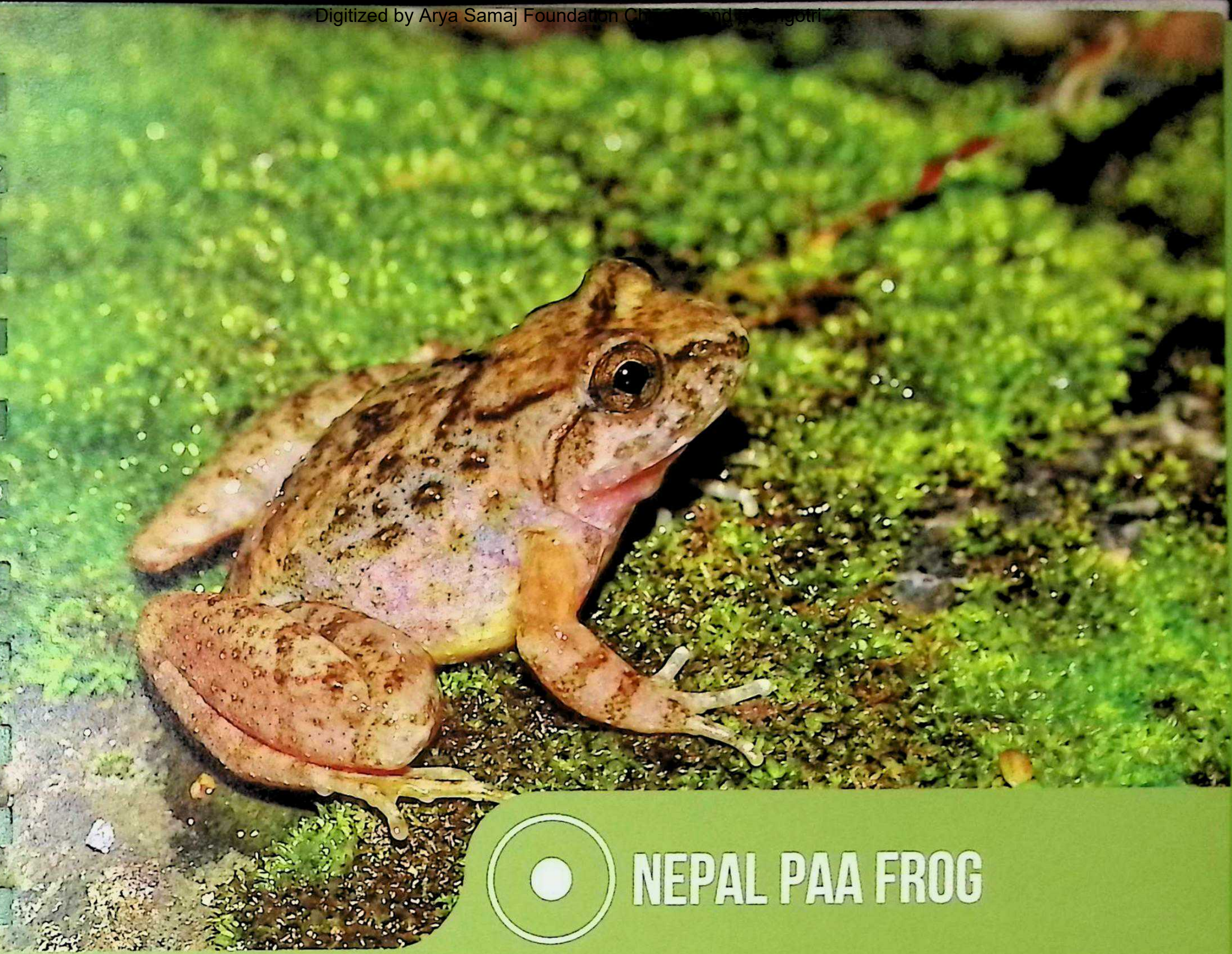
HIMALAYA PAA FROG

Himalaya Paa frog (*Nanorana vicina*) is restricted to northern Pakistan and north western India. It is a high-altitude species and is reported from Himacahal Pradesh, Uttarakhand and Jammu & Kashmir. The species is found in the upper stretch of the Ganga River, at elevations of 2000-3000 m asl.

It is a medium sized frog of 58 mm. Body is olive in colour with marblings. The tympanum is indistinct, first finger as long as second, toes half webbed, outer metatarsal tubercle reduced, and the body dorsum is tuberculate.

The species inhabits high-altitude streams, springs, fountains and other running waters within open forest and grassland habitats. *N. vicina* is vulnerable due to destruction of stream habitats.

Scientific Name	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Province
Nanorana minica	**Vulnerable**	**Not listed**	**West Himalaya (2B)**



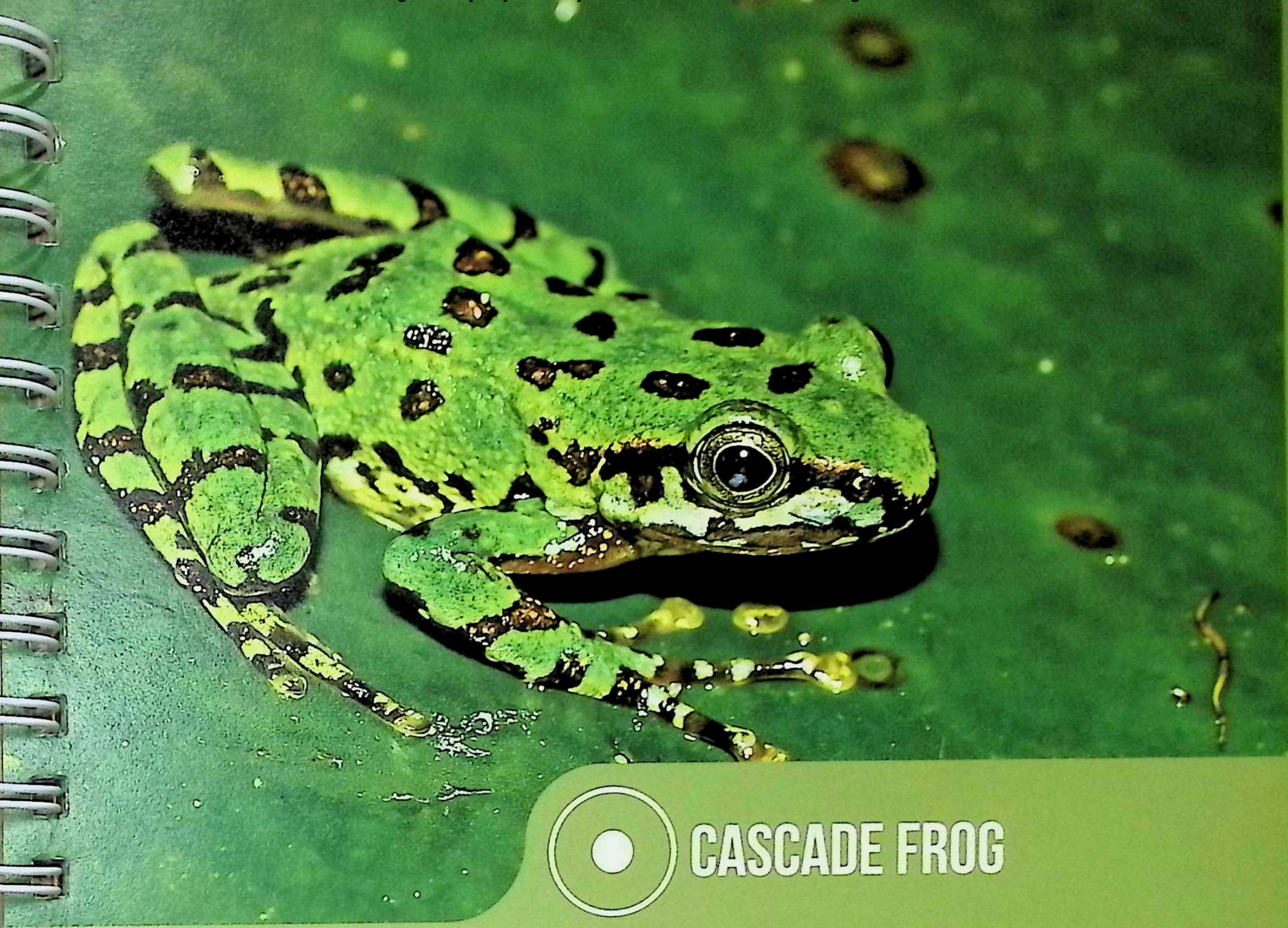
NEPAL PAA FROG

Nepal Paa frog (*Nanorana minica*) has been reported from western and eastern Nepal and from northern India in Uttarakhand and Himachal Pradesh. It is reported from the upper stretch of the Ganga River from 1000 to over 2400 m asl.

It is a relatively small bodied frog of 28-41 mm in size. Body is brownish in colour with black spots and small warts on the back side. The snout to vent length is 1.6 inches. It inhabits subtropical montane forests and breeds in streams.

Currently the population of the species is in decline, due to localized clearance of forests, changes in waterway management due to dam construction and pollution.

Scientific Name	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Province
Nanorana vicina	Least concern	Not listed	West Himalaya (2B)



CASCADE FROG

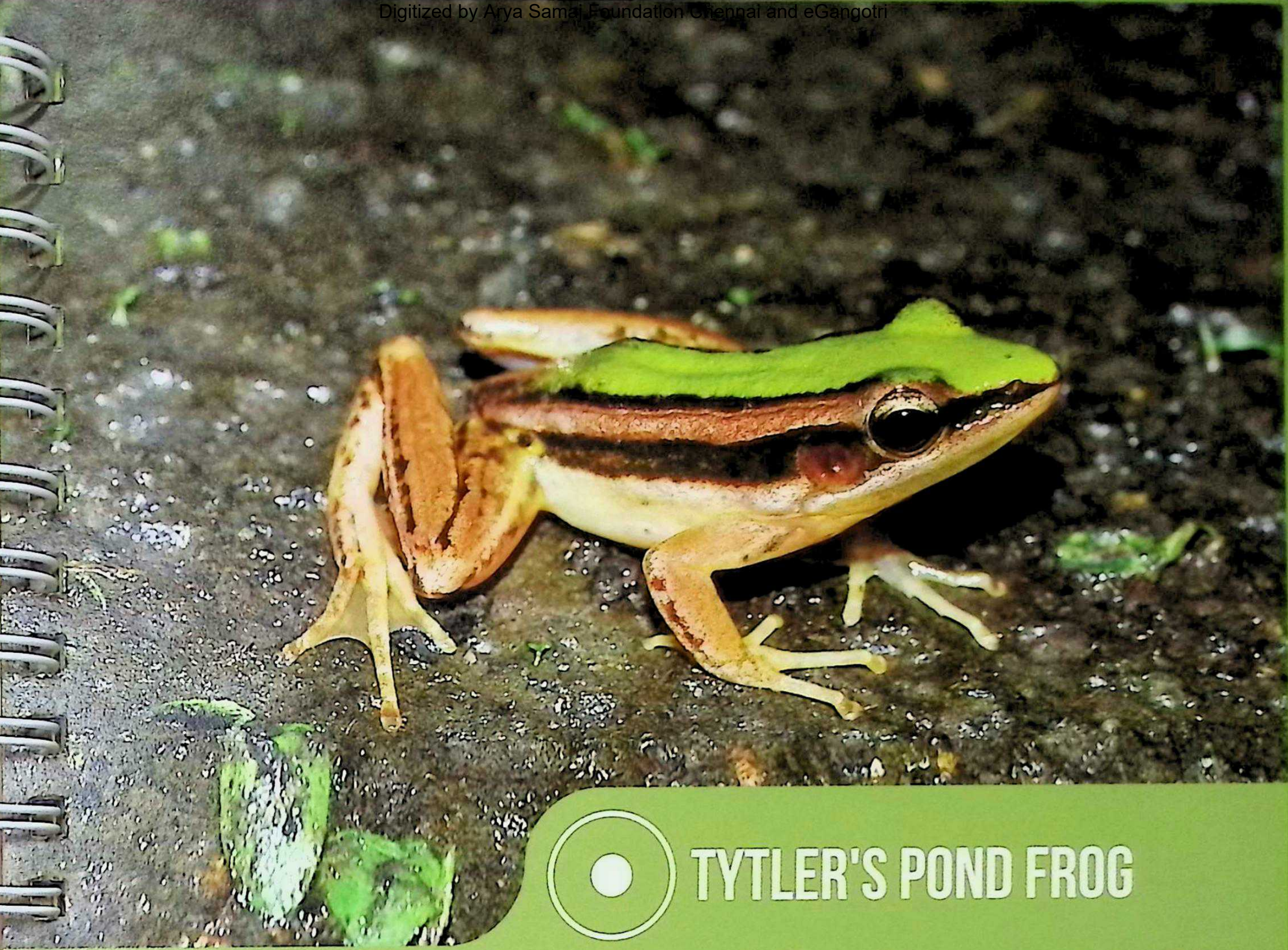
Cascade frog (*Amolops formosus*) has been recorded from India in Himanchal Pradesh, Uttarakhand, Nagaland, Meghalaya, Arunachal Pradesh and Assam; northern Bangladesh and much of Nepal. In the Ganga River, it is reported in the upper stretch within an altitudinal range of 1000-2500 m asl.

The species is 50-65 mm in length. It has a green to brown color on its back and a light yellow on its throat and belly. A few to about 50 gray spots are present on its back. The color patterns are used to attract mates.

The species is associated with streams and riparian vegetation within tropical evergreen forests. They are obligate stream dwelling species and breeding takes place in streams. Their tadpole has ventral suckers to attach to the substratum.

The overall population of the species is declining due to continuing loss of suitable stream habitats through both deforestation and changes in natural hydrology regime as a result of dams.

Scientific Name	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Province
Amolops formosus	Least Concern	Not listed	West Himalaya (2B)



TYTLER'S POND FROG

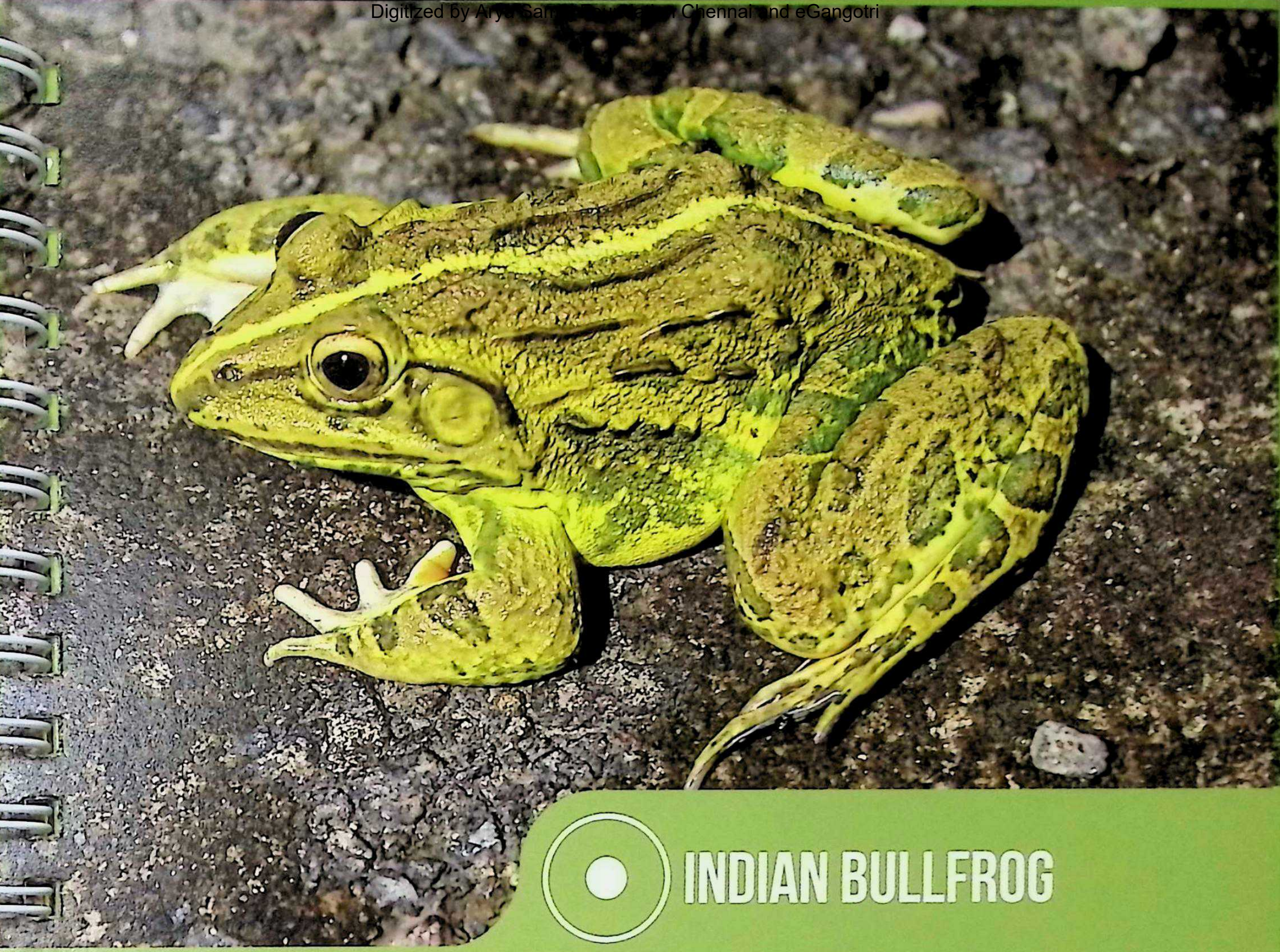
Tytler's pond frog (*Hylarana tytleri*) is distributed in much of northeastern India, throughout Bangladesh and southern Nepal. In India the species is found in Assam, Meghalaya, Mizoram, Nagaland, Odisha, Uttar Pradesh and West Bengal. It has been reported from the middle and lower stretches of the Ganga River up to 300 m asl.

The males of the species grow to a maximum size of 33 mm and females to 45 mm. The head is moderately elongated and webbing is partial. The body is uniformly greenish with two whitish or yellow lines laterally on back. There are two distinct brown lines on inner side of latero-dorsal folds.

It inhabits a variety of aquatic habitats such as pools, lakes and marshes. It may also be found in riparian vegetation, within scrubland, tropical forest habitats and in artificially flooded agricultural areas. The species generally breeds in stagnant waterbodies.

Although the current population status of this species is reported to be stable, the species is vulnerable to water pollution as a result of agrochemicals and due to overexploitation as food.

Scientific Name	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Province
Hylarana tytleri	Least Concern	Not listed	Lower Gangetic Plain (7B)



INDIAN BULLFROG

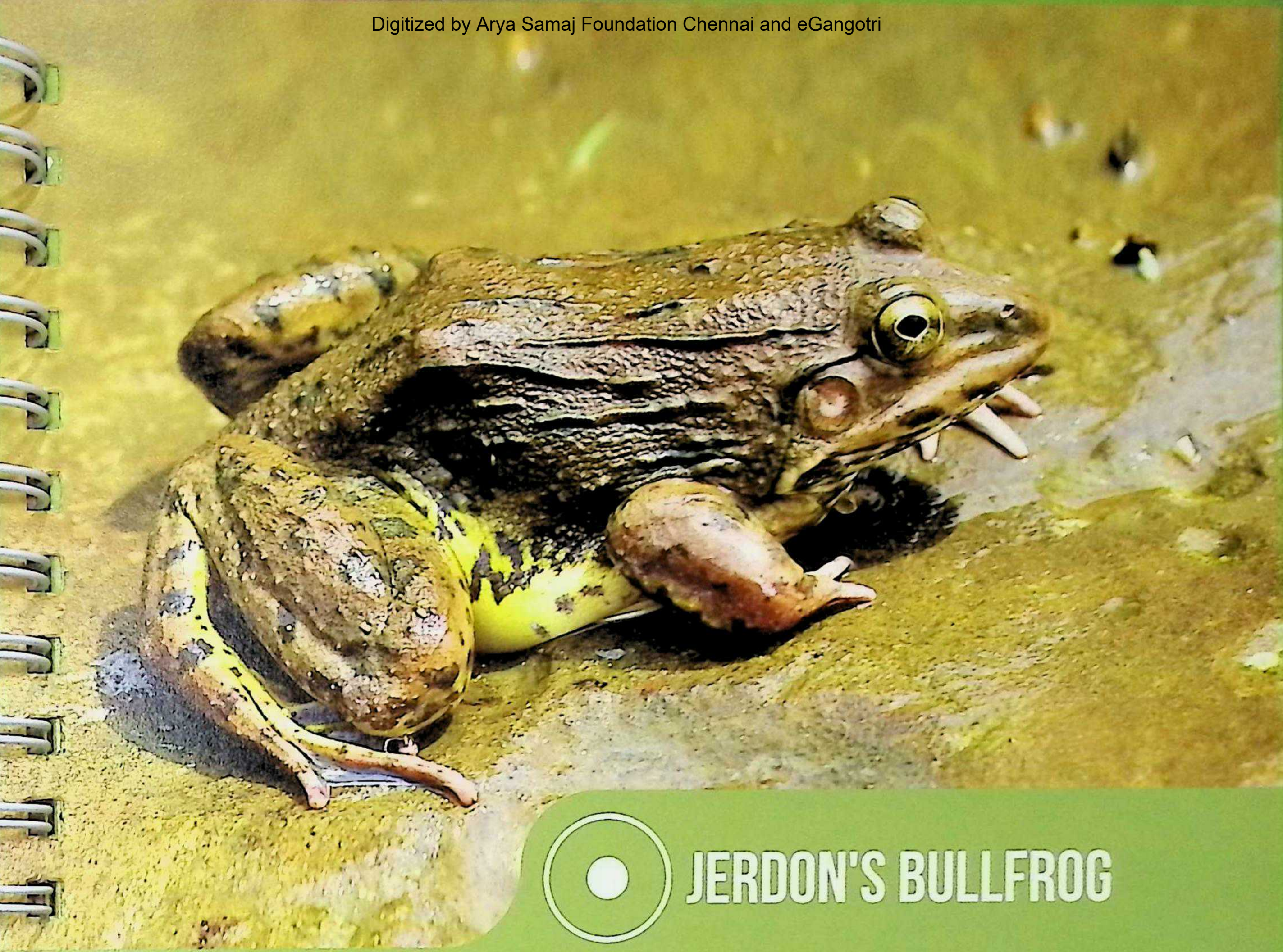
Indian bullfrog (*Hoplobatrachus tigerinus*) is found throughout most wetland areas of India, Bangladesh, northern Pakistan, southern parts of Nepal, Myanmar and Sri Lanka. The species has been introduced in the Maldives and Madagascar, where it is expanding its range. It is a lowland species, found at elevations between 25 and 800 m asl. The species is widely distributed throughout India. It is found in all the three stretches of the Ganga River.

It is a large sized frog of 134 mm. The body is greenish, olive or brown in color with a mid-dorsal yellow line on the back. The breeding males are yellow in color, with deep blue vocal sacs, with powerful, nasal calls.

The species mainly inhabits freshwater wetlands, and paddy fields. It is solitary and nocturnal in behavior, residing in holes and bushes near pools and water courses. It feeds on invertebrates, small mammals and birds. Breeding occurs during the monsoon season, during which the adults congregate at ephemeral rainwater pools. Although the species produces large number of eggs, mortality rates are high.

In the past, the species was collected in huge quantities for the international frog-leg trade. Since the 1990's legal export of this species is banned in India and Bangladesh. The population of the species is currently reported to be declining due to threats such as loss of wetland habitats, water pollution from agrochemicals, road mortality and consumption as food.

Scientific Name	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Provinces
Hoplobatrachus tigerinus	Least Concern	Schedule IV	West Himalaya (2B), Gangetic Plain (7A &7B), East Coast (8B)



JERDON'S BULLFROG

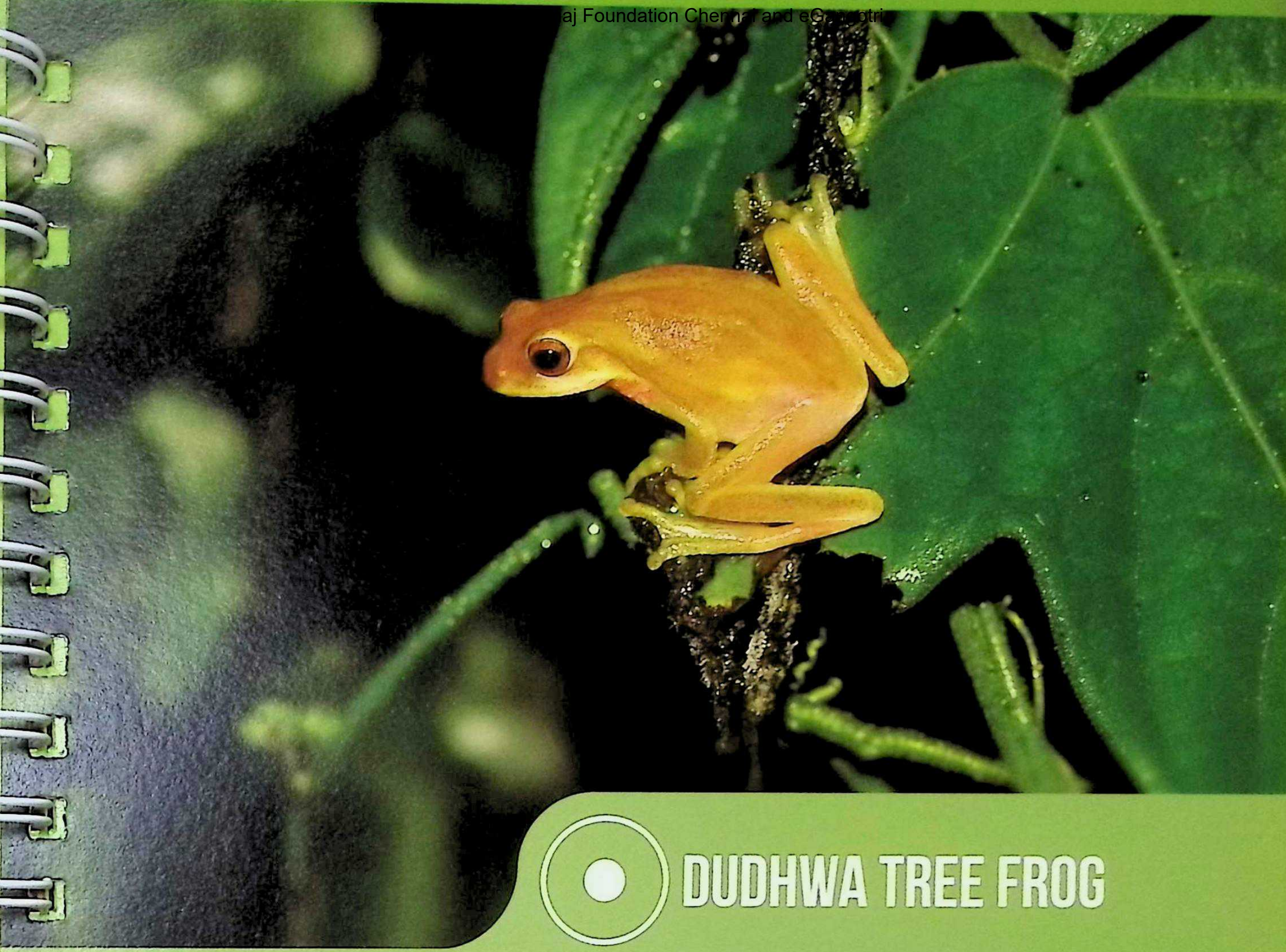
Jerdon's bullfrog (*Hoplobatrachus crassus*) is present almost throughout south Asia in India, Bangladesh, Nepal and Sri Lanka. The species has been recorded from most parts of India viz., Andhra Pradesh, Assam, Arunachal Pradesh, Kerala, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Uttar Pradesh, Uttarakhand and West Bengal. It is found in all the three stretches of the Ganga River.

It is a large sized frog of 121 mm. The dorsal part of the body is brown with dark spots and irregular glandular folds are present on the back.

The species is mainly terrestrial and inhabits seasonally flooded grasslands, open plains, cultivated areas and around human settlements, however breeding take place in various types of waterbodies. During dry periods, adults aestivate and are generally found in burrows.

Currently, population of the species is declining. Habitat loss, adult mortality due to road kill and collection for use as food are the major threats.

Scientific Name	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Province
Hoplobatrachus crassus	**Least Concern**	**Schedule IV**	**Lower Gangetic Plain (7B)**



DUDHWA TREE FROG

Dudhwa tree frog (*Chiromantis dudhwaensis*) is an endemic species, currently known only from its type locality in Dudhwa National Park, Uttar Pradesh, India, where it was observed and collected below 100 m asl. However, the species is expected to occur more widely in the Gangetic basin.

It is a semi-arboreal species and mainly inhabits scrub forest, grassland and rural areas. The species may be vulnerable to habitat loss and climatic shifts, however research is underway to identify specific threats.

Scientific Name	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Province
Chiromantis dudhwaensis	**Data Deficient**	**Not listed**	**Upper Gangetic Plain (7A)**

FISH

About 15000 species of freshwater fish have been recorded globally; of which, about 6.6% are found in Indian inland waters. Out of the 994 species so far listed, 482 species are endemic to India and almost 120 species are threatened according to IUCN Red List.

About 200 fish species have been reported from the Ganga River. The distinctive hydrology and geo-climatic condition in the upper, middle and lower stretches of the river support unique fish assemblages. Fish presently found in the Ganga River belong to Class Actinopterygii, however historical records show that fishes belonging to Class Elasmobranchii were also found in the Ganga River. Among the Elasmobranchii, two species of Stingray were reported uptil Kanpur and the Gangetic shark (*Glyphis gangeticus*) was reported in the Ganga River beyond the tidal range. The present status of these species is mostly unknown.

Fish form the staple diet for a majority of people in India and it is a major source of animal protein for low income families. Fishing is an important income source for most of theriverside communities along the Ganga River. Fishes also contribute to the overall economic wellbeing as a means of export commodity, tourism and recreation.

According to the feeding guilds, the freshwater fishes of the Ganga River may be divided into Zooplanktivore, Zoobenthivore, Herbivore, Piscivore, Opportunist/Omnivore and Detritivore. They regulate trophic structure and thus, influence the stability, resilience, and food web dynamics of aquatic ecosystems. They also influence the temporal availability of nutrients and the potential for algal blooms in nutrient-rich lakes. These fishes mineralize nitrogen and phosphorus through excretion and defecation, thereby making these nutrients available for primary production. The piscivores and omnivores exert a top-down control over fish populations. Fishes control the sediment process as the detritivores and zoobenthovore search for food and to lay their eggs in the bottom sediment. The seasonal migration of fish for breeding and spawning transport nutrients across the river and floodplain wetlands. As bioindicators, freshwater fishes also give out early-warning signals of anthropogenic stress on natural ecosystem dynamics, or conversely, as indicators of ecosystem recovery and of resilience.

During the rapid biodiversity assessment, golden mahaseer, mahaseer and snow trouts were encountered only in the upper stretch of the river. Wallago was frequently observed in the middle and lower stretches. Whereas, Hilsa was only encountered in the lower stretch of the river downstream Farakka barrage in the mainstem of the Ganga River and in the Feeder Canal.

GOLDEN MAHASEER

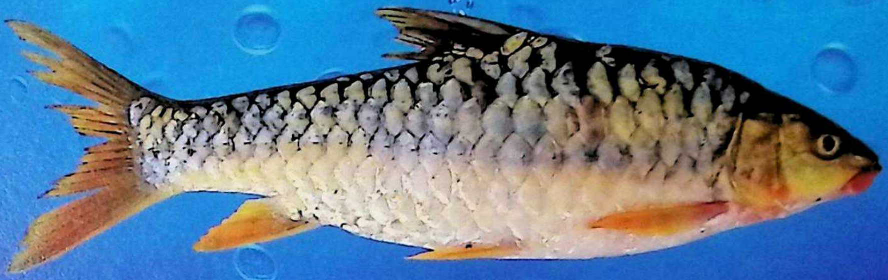
Golden Mahaseer (*Tor putitora*) has been reported from across the Himalayan region and elsewhere in south and southeast Asia. In India, the species is found in the Himalayan river systems of Himachal Pradesh, Uttarakhand and Jammu & Kashmir. In Uttarakhand, it has been reported from the Nayar, Mandal, Khoh and Sharda rivers. It is also found in the Song-Ganga river confluence.In the Ganga River, it is restricted to the upper stretches within an elevation range of 70-1891m asl.

Putitor mahaseers are large cyprinids and are known to be the toughest freshwater sport fish. It can attain a maximum length of 2.75 m and weighs 54 kg. The body colour of an adult is golden on dorsal side and fins are reddish-yellow. It is characterized by large scales and thick powerful lips with relatively longer barbels

The species inhabit montane and sub-montane regions, in streams and rivers with rocky bottom, riverine pools and lakes. It is a column feeder in freshwater, found in pH ranges 7.4-7.9 and in subtropical condition 13°C - 30°C. It is omnivorous, feeds on insects, algae, macrophytes, rotifers, small fish and crustaceans. It is potamodromous (migrating within freshwaters) and migrates upstream from the main river to the tributaries for spawning during the pre-monsoon and monsoon and return during October-November. The fish breeds in shallow water regions and the fry hide themselves under big boulders near the banks. The adult fish prefer deeper pools.

Currently the species is declining rapidly from its natural habitat due to urbanization, illegal encroachment, over-fishing and chemical and physical alterations of their natural habitats due to the growing number of hydroelectric and irrigation projects.

Scientific Name	Vernacular Name	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Province	Important areas along the Ganga River
Tor putitora	**Mahaseer, Chadu, Corchula, Putitor**	**Endangered**	**Not listed**	**West Himalaya (2B)**	**Upper stretch of the river**

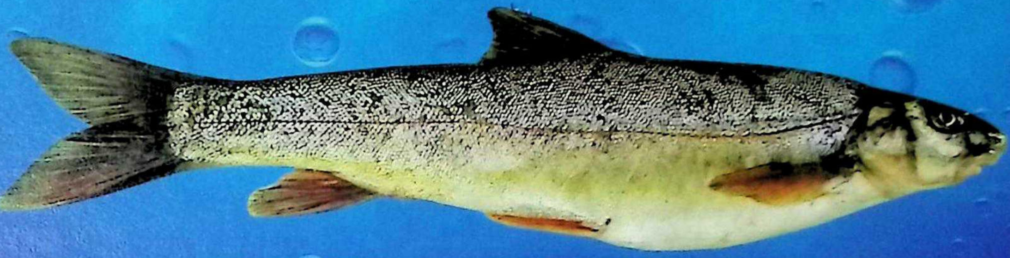


MAHASEER

Mahaseer (*Tor tor*) has been recorded from Myanmar, Bhutan, Bangladesh, Pakistan, Nepal and India. In India,it has been reported from Assam, Arunachal Pradesh, Manipur, Meghalaya, Sikkim, and Uttarakhand. In the context of the Ganga River, tor mahaseers are confined to the upper stretch within an elevation range of 135-1891m asl. They are stoutly built reaching a maximum length of 1.5 to 2 m and weigh upto 78 kg or more. The characteristic feature is its small mouth with thick lips. It is omnivorous and feeds on filamentous algae, water beetles and crustaceans.

The species inhabits rivers and rapid streams with rocky bottom, within 15°C to 30°C. Tor mahaseer is potamodromous, it travels toward headwaters at the start of the rainy season and downstream at the end of the rainy season. It has a long breeding season, which commences in July-August and continues up to December with peak breeding during July to September. The species is an important food and sport fish across its range. Currently its population is declining rapidly due to overexploitation and habitat loss.

Scientific Name	Vernacular Name	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Province	Important areas along the Ganga River
Tor tor	**Mahaseer, Naharam, Mahashoal, Tor mahaseer**	**Near Threatened**	**Not listed**	**West Himalaya (2B)**	**Upper stretch of the river**



SNOW TROUT

Snow trout (*Schizothorax richardsonii*) is widely distributed in India, Nepal, Bhutan, Pakistan and Afghanistan. In India, it is found in the snow fed streams of Uttarakhand, Nagaland and Jammu & Kasmir. The species is confined to the upper stretch of the Ganga River, from Gangotri to Pauri Garhwal. It is generally found within an elevational range of approximately 1000-3500m. The body of the snow trout is streamlined and scales are very small. It is characterised by the presence of a suctorial mouth and about 97 scales on the lateral line.

It inhabits moutain streams and rivers, with rocky substrate. It is a bottom feeder and feeds on algae, aquatic plants, detritus and insects. It is potamodromous and breeds during April-May, before the monsoon floods the rivers and streams. The fry grows to such a size as to bear the rigours of the flood waters.

Snow trout is a valuable game fish and is also relished for its flesh. The population of the species has been drastically declining due to anthropogenic threats such as dams, overfishing, tourism, introduction of exotic species and fishing for ornamental purpose.

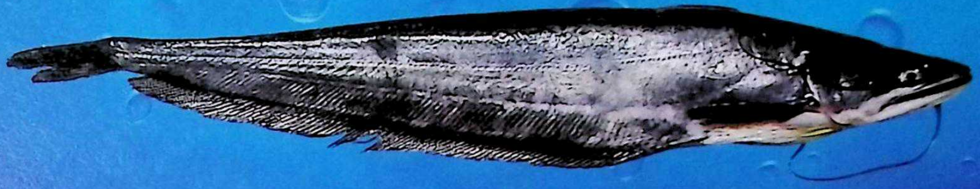
Scientific Name	Vernacular Name	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Province	Important areas along the Ganga River
Schizothorax richardsonii	**Asaila**	**Vulnerable**	**Not listed**	**West Himalaya (2B)**	**Upper stretch of the river**

HILSA

Hilsa (*Tenualosa ilisha*) is one of the most important tropical fish of the Indo-Pacific region. In India, the species has been reported from the Ganga, Brahmaputra, Bhagirathi-Hooghly, Rupnarayan, Godavari, Narmada, Tapti and other coastal rivers. In the Ganga River, it is now confined only within a stretch downstream of the Farakka barrage. Before the construction of this barrage, Hilsa used to migrate up to Agra, Kanpur and Delhi in years of excessive abundance, while in normal years, up to Allahabad. The species can attain a length of up to 60 cm and weigh around 2.5 kg. It is silver in color consisting of 18-21 dorsal soft rays, 18-23 anal soft rays and 30-33 scutes on the belly. Dorsal spines and anal spines are absent. A dark blotch is present behind the gill opening, followed by a series of small spots along flank in juveniles.

It is a euryhaline species, inhabiting lower regions of foreshore areas, estuaries, brackish-water lakes and freshwater rivers, due to the presence of sub surface oxygen, relatively low salinity, strong tidal action, high turbidity, heavy siltation and rich growth of plankton. It feeds on planktons, mainly by filtering, but also practices grubbing on muddy bottoms. The species is an anadromous clupeid, it schools in coastal waters and migrates into the rivers for as much as 50-100 km for spawning. It is known to be a fast swimmer, sometimes covering 71 km in a day. Spawning mainly occurs in the river during the southwest monsoon period and also from January to March. The population of this species is declining rapidly due to the construction of dams and barrages, siltation in estuary mouth, juvenile fishing, exploitation of brood fishes, over fishing, lack of mesh size regulation, ineffective fish pass, loss of habitat, and pollution.

Scientific Name	Vernacular Name	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Provinces	Important areas along the Ganga River
Tenualosa ilisha	Hilsa, Ilish	Least Concern	Not listed	Lower Gangetic Plain (7B), East Coast (8B)	Lower stretch of the river downstream of Farakka barrage.



WALLAGO

Wallago (*Wallago attu*) is a widely distributed species found in Pakistan, Sri Lanka, Nepal, Bangladesh, Myanmar, Thailand, Vietnam, Cambodia, Java and all across India. The species has been reported from across India and is found in the middle and lower stretches of the Ganga River.

It is a large fish with a broad head, depressed snout and a strongly compressed and elongated body. Mouth consists of a deep cleft, with its corners reaching far behind the eyes. Teeth in the jaws are set in wide bands; vomerine teeth in two small patches are present. It comprises of five dorsal soft rays and 77-97 anal soft rays. It bites strongly, with its huge mouth, forming jaws and band of conical teeth.

The species inhabits large, rivers, tanks and lakes. It is among the largest, voracious and predatory of local catfish, which thrives well in rivers, lakes and ponds with grassy margin. It is associated with deep, still or slow flowing water with a mud or silt substrate. The species is carnivorous and predatory in nature. Adults are piscivorous and juveniles feed mainly on insects and adults feed on smaller fish, crustaceans and molluscs. It is potamodromous and a pre-monsoon summer breeder. It is found abundantly during the warm seasons.

Wallago is heavily utilized as food. Occasionally juveniles are caught and exported as ornamental fish. It is considered as a good sport fish and is generally targeted by recreational fisherman.

Habitat destruction and overexploitation of this species is a major cause for the rapid decline in its population.

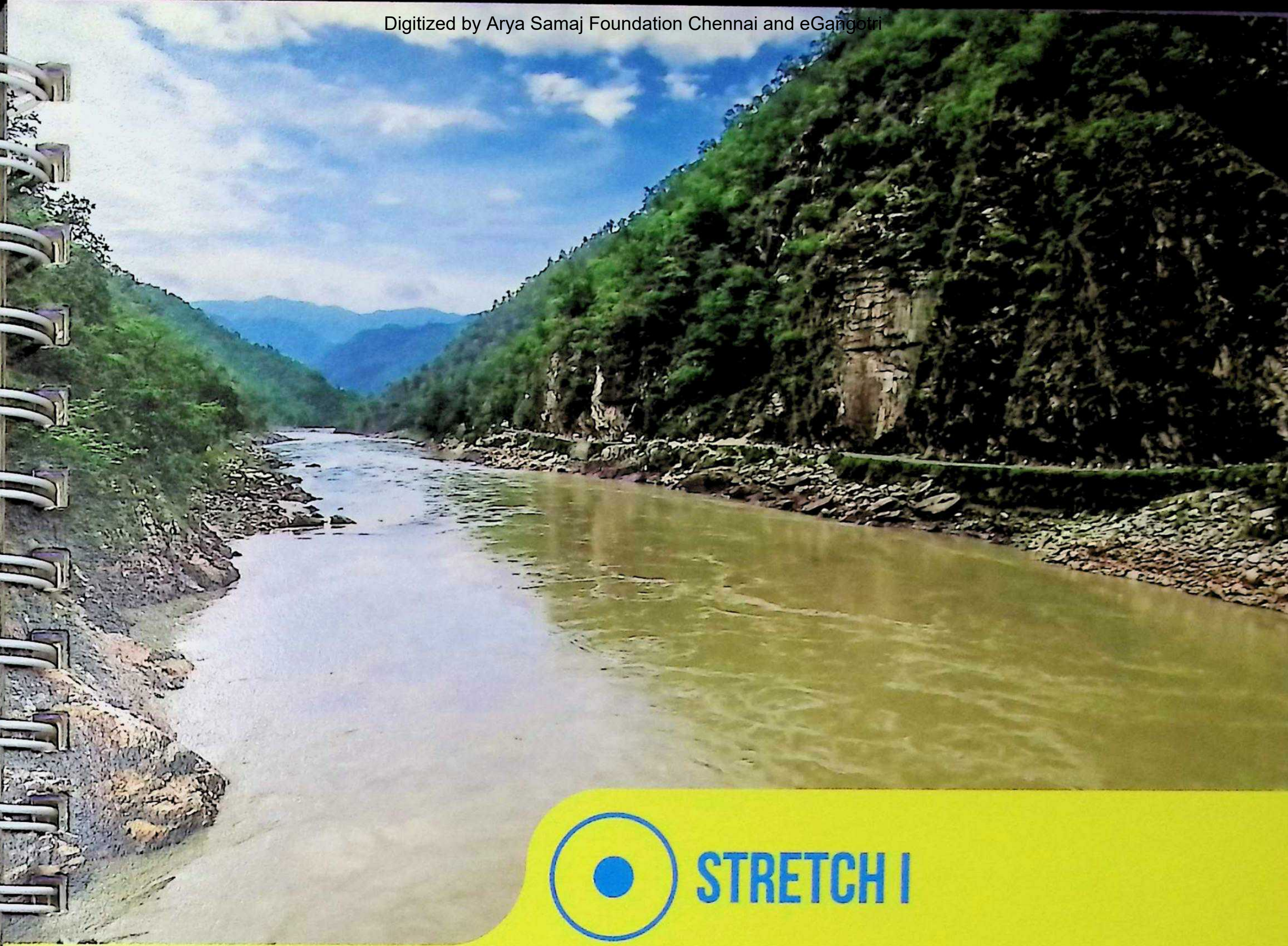
Scientific Name	Vernacular Name	IUCN Red List	Indian Wild Life (Protection) Act, 1972	Biogeographic Provinces	Important areas along the Ganga River
Wallago attu	**Boal, Barwari, Boalee, Boyari, Valai, Paran**	**Near Threatened**	**Not listed**	**Upper & Lower Gangetic Plains (7A & 7B); East Coast (8B)**	**Middle and lower stretches of the river from Haridwar to Ganga Sagar**

HIGH BIODIVERSITY STRETCHES

Identification of areas with high biodiversity values for ecological restoration is based on the 'refuge approach' to restoration. This approach provides resilience and sources for future restored sites and a measure against the likelihood of local extirpation of species.

For the ecological restoration of the Ganga River, stretches with high biodiversity values were identified using information obtained from the rapid biodiversity assessment. Habitat defining variables such as water depth were also determined along the surveyed length of the river, as depth is a major limiting factor for most of the priority umbrella species. The umbrella species like the Gangetic river dolphins and gharials are highly dependent on the depth profile. They prefer depth > 4 m, which was available in scattered pools in approximately 38.7% of the river stretch assessed. Shallow areas (depth <4 m) prevail throughout the river stretch which act as barriers to the lateral movement of these large-bodied aquatic animals.

Six stretches covering about 50% of the river's length that have high biodiversity value were identified along the Ganga River.



STRETCH I

- This is a stretch of 61 km, from Devprayag to Rishikesh in Uttarakhand and falls under the West Himalaya (2B) Biogeographic province.
- It is characterized by rapids with rocky bottoms, deep gorges and gentle slopes.
- 56 species of fish including Golden mahaseer were encountered in this stretch. This stretch along with the Nayar River provides breeding grounds for the Golden mahaseer.
- Semi-aquatic mammals such as the smooth-coated and Eurasian otters have been reported from this stretch. There are also reports of Asian small-clawed otter from the narrow streams joining Ganga River.
- About 93 phytoplankton, 76 periphyton and 19 zoobenthic species have been reported.
- Riffles and pools provide habitat heterogeneity for the benthic flora and periphyton and forms headwaters for the lower stretches of the Ganga River.

DEVPRAYAG TO RISHIKESH, UTTARAKHAND

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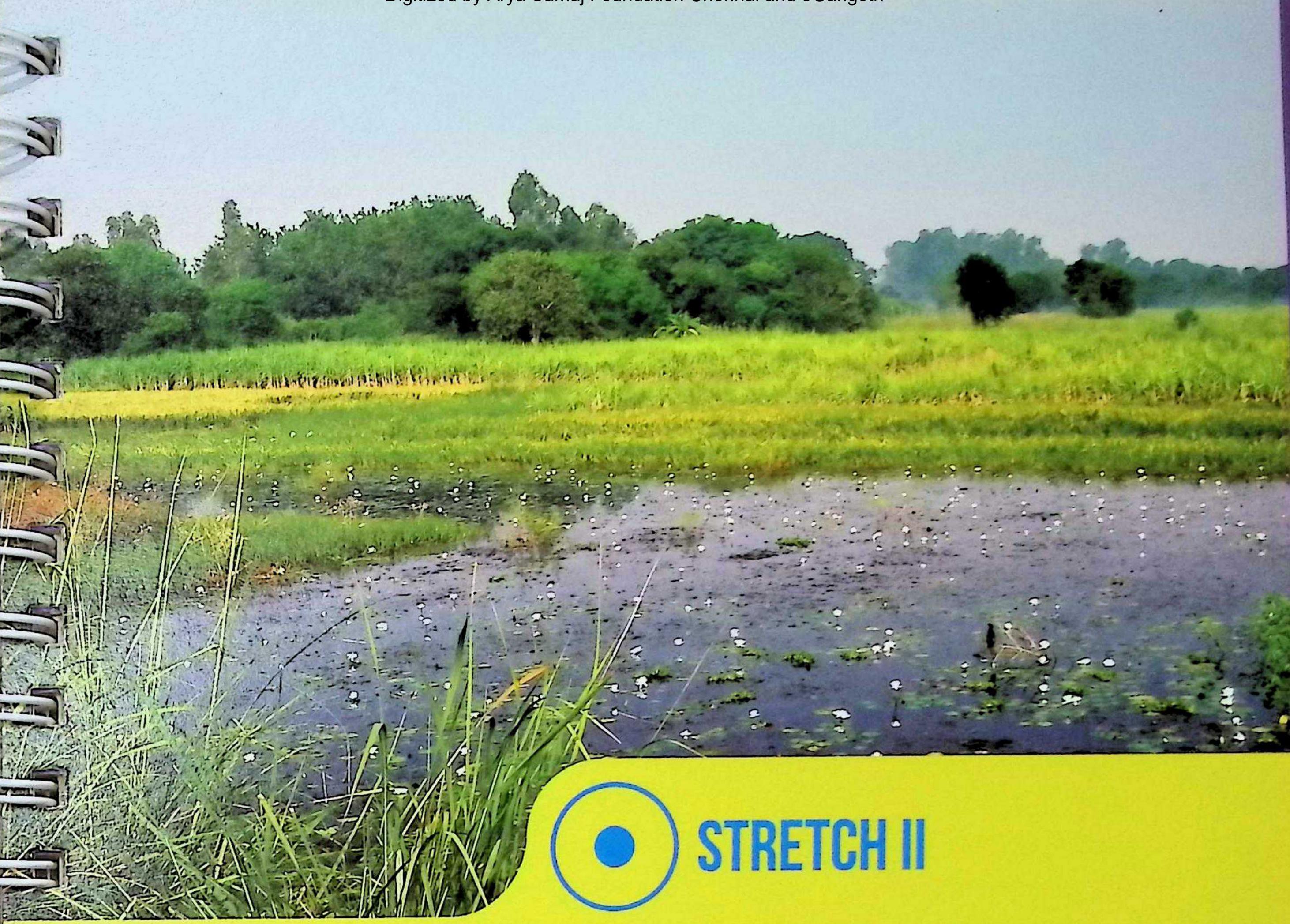
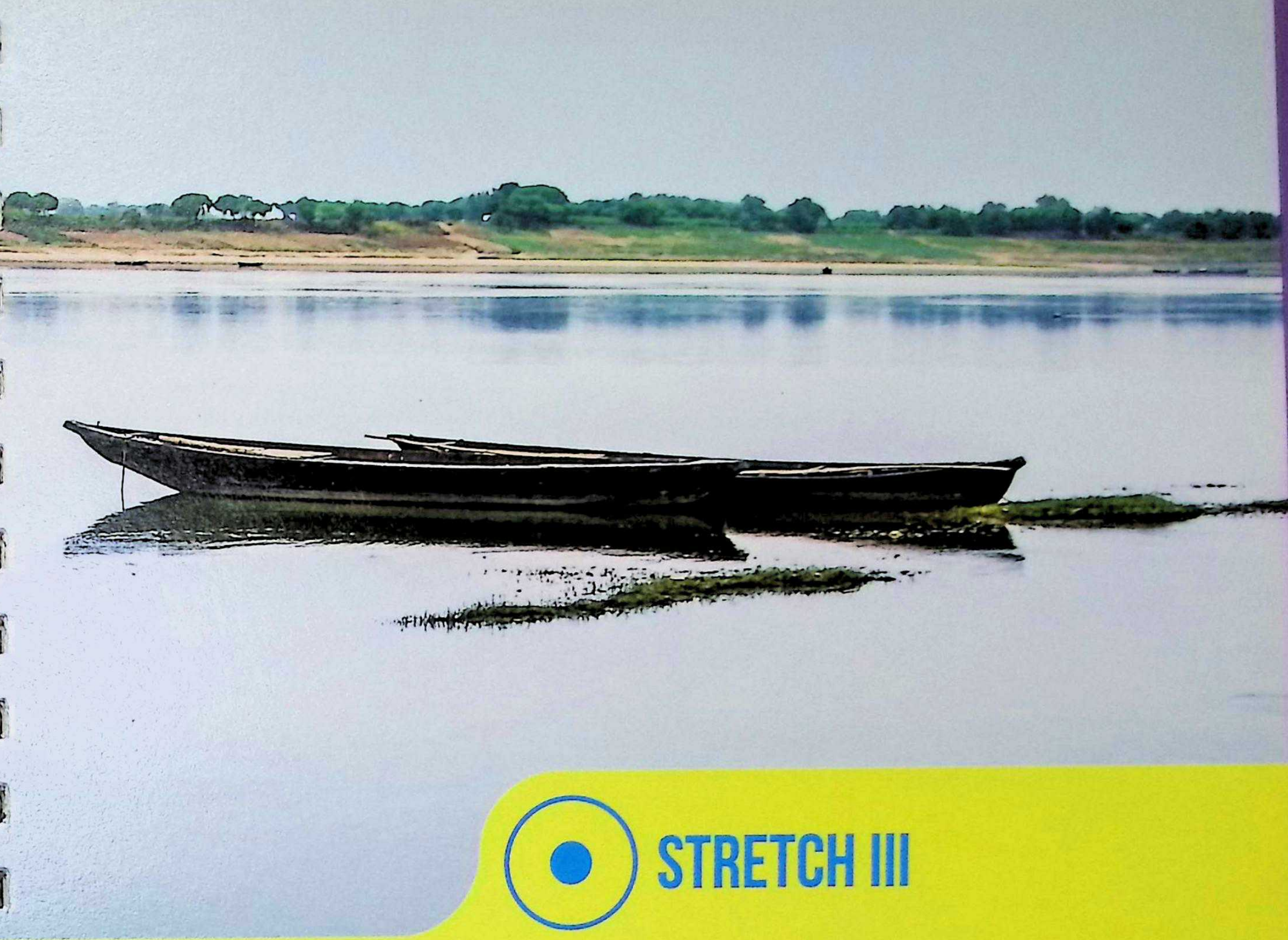


STRETCH II

- This is a 147 km stretch from Makdumpur in Jyotibha Phule Nagar to Narora in Bulandshahar district, Uttar Pradesh.
- This stretch falls under the Upper Gangetic Plain (7A) Biogeographic province.
- It is characterized by meandering channels with extensive alluvium, sandbars and mid-river islands.
- Flow regime is highly altered by the Bijnor and Narora barrages.
- During summers, the river depth ranges from 1.6 m to 5.2 m.
- During the rapid assessment a total of 27 gharials were encountered in this stretch. Around 41 sightings of Gangetic river dolphins were made. More than 800 turtles, including 176 individuals of *Batagur* sp., 50 *Nilssonia gangetica* and 619 individuals of *Pangshura* sp., were encountered within this stretch.
- More than 80 fish species and 62 waterbird species were recorded from within this stretch.
- 35 phytoplankton and 31 zooplankton species have been reported from this stretch.
- About 110 km of this stretch is protected as Hastinapur Wildlife Sanctuary and stretch between Brijghat to Narora, is recognized as Wetland of International Importance.
- Presence of sandbars, mid-river islands, backwaters and floodplain wetlands provide habitat mosaics for different aquatic biota.

MAKDUMPUR TO NARORA, UTTAR PRADESH



STRETCH III

- Traversing through an extensive alluvial plain, this 454 km stretch from Bhitaura, Fatehpur to Ghazipur, Ghazipur district, Uttar Pradesh is highly braided and anastomosed.
- This stretch falls under the Upper Gangetic Plain (7A) Biogeographic province.
- Flow regime is altered by the Kanpur Barrage and the river depth goes as low as 1.1 m. The flow regime improves significantly after the conflux with the Yamuna River near Allahabad resulting in an increased river depth of up to 20.4 m.
- A total sightings of 269 Gangetic river dolphins were made in this stretch. Around 193 Indian skimmers were also seen. Sightings of *Batagur* sp. and *Nilssonia gangetica* were also made in this stretch. A total of 50 fish species were encountered during fish sampling.
- The stretch is also known to harbour about 357 phytoplankton, 42 zooplankton, 19 periphtyon and 45 zoobenthic species.
- 7 km length of this stretch from Rajghat to Ramnagar, in Varanasi, is protected as Kachhua Sanctuary.
- A mosaic of habitat in the form of sandbars, meander belts and ox-bow lakes, results in the wide assemblage of aquatic biota.

BHITAURA TO GHAZIPUR, UTTAR PRADESH

STRETCH IV

- This is a 296 km stretch from Chhapra, Saran to Kahalgaon, Bhagalpur district in Bihar.
- This stretch falls under the Lower Gangetic Plain (7B) Biogeographic province.
- The river in this stretch is very wide, highly braided, meandered and passes through an extensive alluvial plain.
- Flow regime of this stretch is enhanced by substantial inflows from the Ghaghra and Son rivers near Chhapra and Gandak River at Patna.
- During summers, the depth ranged from 1.6 m to 33.2 m.
- A total of 141 sightings of Gangetic river dolphins and two smooth-coated otters were seen during the rapid assessment.
- In addition, 61 fish species and more than 80 phytoplankton and zooplankton species have been recorded.
- About 65 km of this stretch from Sultanganj to Kahalgaon, is protected as Vikramshila Gangetic Dolphin Sanctuary.
- Large, stable islands, meanders and ox-bow lakes provide a mosaic of habitats for the aquatic fauna.

CHHAPRA TO KAHALGAON, BIHAR

STRETCH V

- This 34 km stretch from Sahibganj to Rajmahal, Sahibganj district in Jharkhand is very wide, highly braided and anastomosing with multichannel formation on an alluvial plain.
- This stretch falls under the Lower Gangetic Plain (7B) Biogeographic province.
- Channel splitting takes place and convex sandbars are formed due to the low-energy channel flow and poor lateral stability.
- Flow regime of this stretch is enhanced by substantial inflows from the Kosi River near Katihar District, Bihar.
- During summers, the depth ranged from 1.5 m to 17.0 m.
- Around seven sightings of Gangetic river dolphins were made in this stretch. A family of smooth-coated otter was also encountered in this stretch.
- About 89 species of fish, 182 phytoplankton and 40 zooplankton species have been recorded from this stretch.
- The habitat mosaic includes deep pools, sandbars and mid-river islands, which are potential habitats for freshwater turtles, island-nesting birds and dolphins.

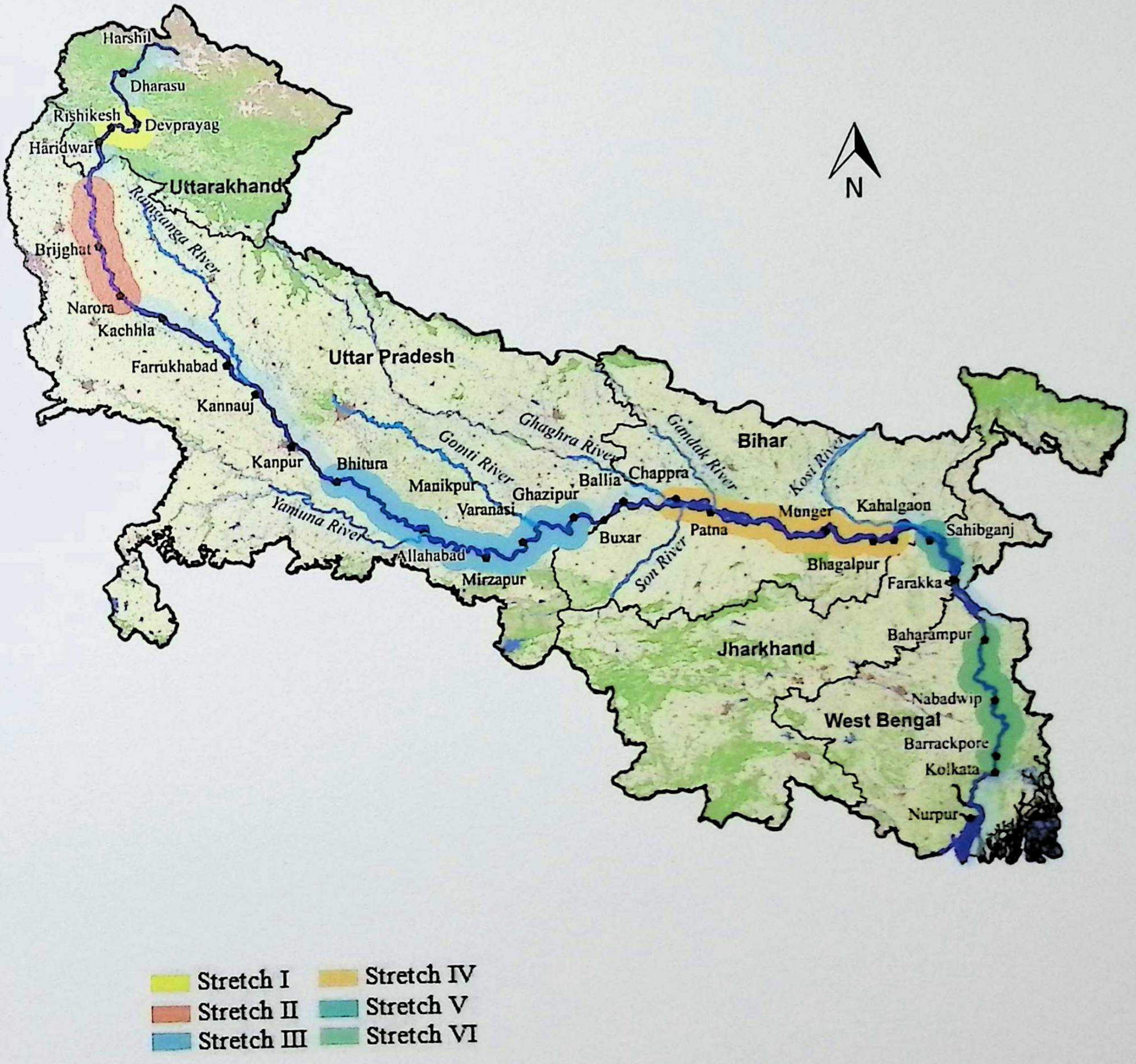
SAHIBGANJ TO RAJMAHAL, JHARKHAND

STRETCH VI

- This stretch of 246 km from Baharampur, Murshidabad to Barrackpore, North 24 Parganas District West Bengal is characterized by highly meandering channel, with convex sandbars and a few mid-river islands.
- This stretch falls under the Lower Gangetic Plain (7B) Biogeographic province.
- Flow regime is enhanced by the feeder canal originating from Farakka Barrage and meeting the main channel, Hooghly at Ahiran, Murshidabad district.
- The river receives substantial inflows from the Mayurakshi and Ajay rivers at Bardhaman district.
- During summers, the depth of the river ranged from 2.9 m to 31.0 m.
- Around 49 sightings of Gangetic river dolphins were made in this stretch.
- 25 species of fish, 44 phytoplankton and 21 zooplankton species were recorded from this stretch.
- Meanders with convex sandbars and mid-river islands provide a mosaic of habitat.

BAHARAMPUR TO BARRACKPORE, WEST BENGAL

STRETCHES IN GANGA RIVER WITH HIGH BIODIVERSITY VALUE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Manikpur
Ghazipur
Varanasi
Yamuna River
Allahabad
Mirzapur
Ballia
Chappra
Gandak River
Bihar
Kosi River
Buxar
Patna
Son River
Munger
Kahalgaon
Bhagalpur
Sahibganj
Farakka
Jharkhand
Baharampur
Nabadwip
West Bengal
Barrackpore
Kolkata
Nurpur
Stretch I
Stretch II
Stretch III
Stretch IV
Stretch V
Stretch VI

THREATS AND CONSERVATION ISSUES

The Ganga along with the Brahmaputra River, forms one of the largest and most diverse river systems of the world, spanning 10 biomes. The varied geomorphological features along the river, coupled with climatic variations, results in a continuous gradient of habitats for various life forms, right from the headwaters to itsb mouth.

The Ganga River basin hosts a dense population of diverse stakeholders having varied resource uses and linked to the river culturally, religiously, socially and economically. The differential resource use scenarios by different stakeholders has resulted in varied impacts and threats along the length of the Ganga River. Therefore, a successful ecological restoration of the Ganga River requires identification of site-specific threats and strategic planning on ways to minimize or eliminate them.

During the present assessment by the Wildlife Institute of India under theNMCG sponsored "Biodiversity Conservation and Ganga Rejuvenation"project, the threats and conservation issues related with the biodiversity were assessed. The upper stretch of the Ganga River is threatened by structural changes in the river and altered flow regime, both of which are heightened by the impacts of climate change. Bank alteration, unsustainable resource extraction and changes in water quality are dominant threats in the middle and lower stretches. It can be deduced that alteration of the structural morphology of the river is the key threat, leading to habitat degradation and biodiversity loss. Climate change and altered water quality due to pollution are further threatening the survival of these species.

THE UPPER STRETCH

- **Amidst the Himalayan mountain range, a river stretch of 294 km from Gaumukh to Haridwar is designated as Upper Ganga.**
- **It falls within the West Himalaya (2B) Biogeographic province and is characterized by very steep altitudinal gradient, turbulent high flow, deep gorge, narrow channel, stony or pebbly river bed with intermediate sandy bars and cold water.**
- **The human population density in the basin is about 190 persons/km^2.**
- **This is a highly sensitive and ecologically fragile stretch.**
- **This stretch has high biodiversity value - hosting habitats for endangered species such as otters, the snow trout and the golden mahaseer.**

Conservation issues

A. Structural changes

- 16 existing, 14 ongoing and 14 proposed hydroelectric projects in the Bhagirathi and Alaknanda river basins threatens the Upper stretch.
- 70.7% of the Bhagirathi River and 48.0% of the Alaknanda River are affected by inundation and water diversion.
- 28.6% and 35.2% of the Bhagirathi and Alaknanda river channels have turned into ecological deserts.

B. Climate change impact

- The flow regime in the headwaters is vulnerable to the retreat of the Gangotri glacier.
- The thermal gradient of the aquatic habitat is already distorted.
- Shrunken distribution range of *Schizothorax* sp. and upstream range extensions of *Cyprinus carpio*.

C. Loss of habitat connectivity

- Decline in golden mahaseer population due to the Tehri Dam acting as a migration barrier.

D. Pollution

- Two active drains observed downstream of the Rishikesh Barrage and Haridwar.
- pH ranged from 6.6-8.5, within the permissible limit (6.5-8.5).
- Biochemical oxygen demand (BOD) showed an overall increasing trend, and increased above the permissible limit (? 3 mg/L) near Satyanarayan Temple, downstream of Raiwala and Haridwar.
- Dissolved oxygen (DO) below the critical point (5.4 mg/L) at Haridwar.

Critical locations

Haridwar, downstream of Bhimgoda Barrage.

MIDDLE STRETCH

- **The stretch of 1082 km between Haridwar and Varanasi is designated as Middle Ganga.**
- **Falling within the Upper and Lower Gangetic Plains (7A & 7B) Biogeographic province, it is characterized by anastomosing, meandering flow patterns, wide and narrow channel, sandy river bed, sand bars and islands and extensive alluvium.**
- **The human density is about 820 persons/km^2.**
- **Extensive fertile floodplains that are extensively used for agriculture.**
- **Hosts significant populations of the Gangetic river dolphin, gharial, mugger, turtles and island-nesting birds.**

Conservation issues

A. Reduced flow regime

- Water abstraction from the Upper Ganga Canal at Bhimgoda, Haridwar, Middle Ganga Canal at Bijnor and Lower Ganga Canal and Parallel Lower Ganga Canal at Narora has reduced the flow of the river to 10% of the natural flow regime.
- Bhimgoda, Bijnor, Narora and Kanpur barrages have severely fragmented the habitat and restricted the migration of species along the river.

B. Pollution

- There were 21 wastewater inflow points, mainly of raw sewage and industrial discharge observed during the present study.
- pH ranged from 7.4 to 8.8 mg/L and DO at 7.5 mg/L, which are permissible limits.
- BOD showed overall decreasing trend however higher than the permissible limit was observed at Narora, Kannauj, Kanpur, Dalmau, Kala Kankar, Allahabad and Varanasi.
- Polychlorinated bi-phenyls (PCBs) and Perfluorinatedcompounds (PFCs), used widely in the agricultural and healthcare sectors in this stretch are endocrine disrupting chemicals (EDCs). These interfere with the hormonal and immune systems of aquatic species through bioaccumulation and biomagnification along the food chain, as reported for the Gangetic river dolphin.

C. Agriculture, sand mining and built-up area

- River bed and bank agriculture, construction and sand mining has disrupted the lateral connectivity of the river.
- Extensive sandbar cultivation has rendered the habitat unsuitable for use as nesting sites by turtles and island-nesting birds.

D. Unsustainable resource extraction

- Unsustainable biological resource extraction using destructive methods is ubiquitous, leading to decline in prey base.

Critical locations

- Varanasi and areas between Farrukhabad and Kanpur and between Allahabad and Varanasi.

LOWER STRETCH

- **The stretch of 1134 km from Varanasi to Ganga Sagar is designated as the Lower Ganga.**
- **Falling within the Biogeographic provinces viz. Upper and Lower Gangetic Plains (7A & 7B) and East Coast (8A) and is characterized by extensive alluvium and wide channels subjected to siltation, bank erosion, frequent flooding and alteration in river channel.**
- **Most densely populated of the three stretches with 950 persons/km^2.**
- **The natural vegetation in the catchment extensively replaced by croplands.**
- **Highly biodiverse with populations of the Gangetic river dolphin, otters, gharial, saltwater crocodile, turtles including Northern river terrapin and fishes such as Hilsa.**

Conservation issues

A. Altered flow and salinity regime

- The Farakka Barrage in the Hooghly River has significantly changed the salinity regime, water transparency, suspended sediments and nutrient load and altered the freshwater fish assemblage.

B. Pollution

- There were 31 active wastewater inflow points, mainly of raw sewage and industrial discharge.
- pH ranged from 7.3 to 8.8, which was within the permissible limit.
- DO showed an overall increasing trend and BOD showed an overall decreasing trend. However, Ghazipur, in Uttar Pradesh, and Baharampur, Ghoshpara, Serampore, Dakshineshwar, Shivpur, Garden Reach, Uluberia, Palta and Diamond Harbour, in West Bengal, were critical locations where the BOD was well above the permissible limits.
- Kolkata produces 5114 tonnes of solid waste per day, of which 10% is plastic. The untreated plastic waste disrupts the biodiversity and reaches the Bay of Bengal at a rate of 0.12 million tonnes per year.

C. Unsustainable resource extraction

- Destructive fishing techniques and intentional capture of Gangetic river dolphins, turtles and storks have led to mortality and population declines.
- Batagurbaska and *Glyphis gangeticus* have been extirpated due to indiscriminate killing.

D. Agriculture, sand mining and built-up area

- River bed and bank agriculture, construction and sand mining has disrupted the lateral connectivity of the river.
- Extensive sandbar cultivation has rendered the habitat unsuitable for use as nesting sites by turtles and island-nesting birds.

Critical locations

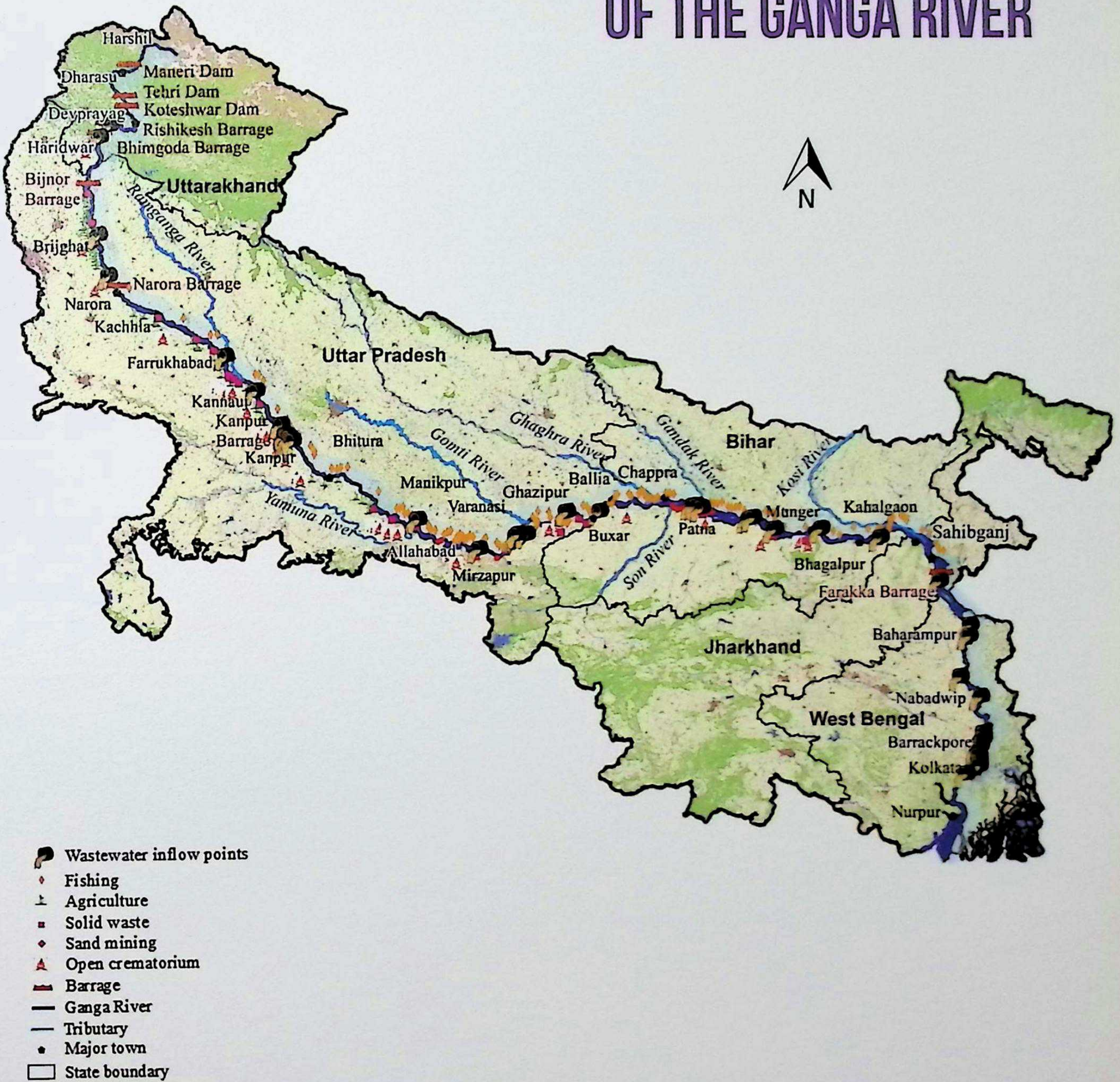
Sitab Diara, Munger, Kahalgaon, Sahibganj, Revelganj and Ajimganj/Jiaganj, Sujapur, Batanagar, Shibpur, Garden Reach, Uluberia and Falta.

STRETCH-SPECIFIC CONSERVATION STRATEGIES

In order to maintain the ecological integrity of the river, it is crucial to address stretch-specific threats keeping in view the current global river conservation scenario.

- In the Upper Ganga, the focus should be on maintaining the natural structural features of the river, and micro-hydel power projects should be considered instead of larger dams in this stretch.
- In the Lower and Middle Ganga, restoration of the hydrology regime through flow augmentation to a near-natural condition would be key to bringing about ecological restoration in the river ecosystem.
- A holistic approach should consider assessment of 'flow-ecology' relationships of designated aquatic umbrella species and then integrate the eco-hydrological requirements of these species during the conception of nature-oriented and ecologically relevant e-flow targets.
- This flow restoration would, in turn, enhance the suitability of the habitat for the aquatic biota, improve the flow regime and retain enough water in the Ganga River to dilute the heavy pollution load.

THREATS TO THE BIODIVERSITY OF THE GANGA RIVER


Harshil
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Devprayag
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Haridwar
Bhimgoda Barrage
Bijnor Barrage
Uttarakhand
Ramganga River
Brijghat
Narora Barrage
Narora
Kachhla
Farrukhabad
Uttar Pradesh
Kannauj
Kanpur Barrage
Kanpur
Bhitura
Gomti River
Ghaghra River
Gandak River
Bihar
Kosi River
Yamuna River
Manikpur
Varanasi
Ghazipur
Ballia
Chappra
Allahabad
Mirzapur
Buxar
Patna
Son River
Munger
Kahalgaon
Sahibganj
Bhagalpur
Farakka Barrage
Jharkhand
Baharampur
Nabadwip
West Bengal
Barrackpore
Kolkata
Nurpur
N
Wastewater inflow points
Fishing
Agriculture
Solid waste
Sand mining
Open crematorium
Barrage
Ganga River
Tributary
Major town
State boundary

PROTECTED AREAS ALONG GANGA

Protected Areas (PAs) viz., National Parks, Wildlife Sanctuaries, Conservation and Community Reserves have been created by the Government of India to protect representative wild habitats across the country. Presently, India has 769 PAs, covering 4.93% of India's geographic area. These PAs cover both terrestrial and aquatic ecosystems and thus provide protection to both terrestrial and aquatic species and their habitats. The PAs along the Ganga River account for 10% of the total river stretch including the Sundarban Tiger Reserve. These areas provide relatively undisturbed habitats along the Ganga River and are repositories of umbrella species such as Gangetic river dolphin, otters and crocodilians.

GANGOTRI NATIONAL PARK

The Gangotri National Park (GNP) (30°50'-31°12' N, 78°45'-79°02' E), is the largest PA (2,390 km^2) in the state of Uttarakhand, and is located in the upper catchment of Bhagirathi River in Uttarkashi District. The origin of the Ganga River, the Gaumukh glacier, is located inside the GNP. Its north-eastern boundary runs along the international boundary between India and China. The elevation of GNP ranges from 1,800 to 7,083 m amsl. It falls within the West Himalaya biogeographic province (2B).

About 26 km of the Bhagirathi flows through the GNP. 15 mammal species and 150 bird species have been documented from the park, which includes snow leopard (*Panthera uncia*), black bear (*Ursus thibetanus*), brown bear (*Ursus arctos*), musk deer (*Moschus chrysogaster*), blue sheep (*Pseudois nayaur*), Himalayan tahr (*Hemitragus jemlahicus*), Himalayan monal (*Lophophorus impejanus*), koklass (*Pucrasia macrolopha*) and Himalayan snowcock (*Tetraogallus himalayensis*).

Among the aquatic species, Asian small-clawed otter (*Aonyx cinereus*), Eurasian otter (*Lutra lutra*) and snow trout (*Schizothorax richardsonii*) are found here.

RAJAJI NATIONAL PARK

Rajaji National Park (RNP) in the state of Uttarakhand is spread across the three districts viz. Haridwar, Dehradun and Pauri (29°15' to 30°31' North Latitude, 77°52' to 78°22' East Longitude). It has a geographical area of 820.42 km^2 in and around the Shivalik foothills with elevation ranging from 302 to 1000 m asl.

About 18 km of the Ganga River flows through RNP and cuts it into two segments, with the Chilla range to the east and the rest on the west side of the river. Due to its strategic location in the Shivalik landscape, RNP has been designated as a reserved area (Shivalik Elephant Reserve) under the "Project Elephant" with the aim of maintaining a viable population of Asian elephants in their natural habitat. It falls within biogeographic provinces West Himalaya (2B) and the Upper Gangetic plain (7A).

Along with elephants, RNP is home to tiger (*Panthera tigris*), leopard (*Panthera pardus*), sloth bear (*Melursus ursinus*), striped hyena (*Hyaena hyaena*), barking deer (*Muntiacus muntjak*), spotted deer (*Axis axis*), sambar (*Rusa unicolor*) and wild boar (*Sus scrofa*).

Among aquatic species, smooth-coated otters (*Lutrogale perspicillata*), Eurasian otter (*Lutra lutra*), mugger (*Crocodylus palustris*), golden mahaseer (*Tor putitora*) are found here.

HASTINAPUR WILDLIFE SANCTUARY

Hastinapur Wildlife Sanctuary is spread across Meerut, Ghaziabad, Bijnore and Jyotiba Phule Nagar districts (29°7′ N to 78°4′E) of Uttar Pradesh. Covering an area of 2073 km², it was declared a Sanctuary in 1986 in order to protect and conserve the ecology and biodiversity of the Ganga River basin.

About 110 km of the Ganga River flows through the Hastinapur Wildlife Sanctuary. The grassland of the Sanctuary holds a variety of flora, avifauna and a population of swamp deer and hog deer. The Sanctuary has a variety of landforms and is a mixture of different habitats such as wetlands, marshes, dry sand beds and gently sloping ravines. The vegetation can be classified into tall wet grasslands, dry short grasslands, scrubs and plantations.

The sanctuary was established to protect the state animal of Uttar Pradesh, the swamp deer (*Rucervus duvaucelii duvaucelii*). Other mammalian species recorded here include hog deer (*Axis porcinus*), blackbuck (*Antilope cervicapra*), nilgai (*Boselaphus tragocamelus*), wild boar (*Sus scrofa*), golden jackal (*Canis aureus*), jungle cat (*Felis chaus*) and fishing cat (*Prionailurus viverrinus*). Along with rich mammalian fauna, the Sanctuary is home to 180 species of birds along with a large congregation of migratory waterbirds visiting the area during winter. Asian openbill (*Anastomus oscitans*) has established several colonies while sarus crane (*Antigone antigone*) is also recorded

KACHHUA SANCTUARY

Turtle Kachhua Sanctuary is located in the Varanasi District (25°44′58.25″N, 83°17′21.24″E) of Uttar Pradesh. This PA is a 7 km stretch of the Ganga River flowing through Varanasi city from Ramnagar Fort to Malviya Rail/Road Bridge.

The Sanctuary was established to ensure the survival of turtles released into the Ganga River in Varanasi. Due to the sacred status of the river and the Varanasi (Kashi) city, people from all over the country come to perform funeral rites and half burnt bodies and religious wastes are often immersed into the river. To get rid of these waste and keeping in view the religious sentiments and cultural values of the people, the Ganga Action Plan supported breeding and release of turtles into the river. The turtles promote organic removal of half-burnt human corpses which are dumped into the river. The idea behind the action was that this will nurture a good population of the already dwindling population of the Indian softshell turtle.

VIKRAMSHILA GANGETIC DOLPHIN WILDLIFE SANCTUARY

The Sanctuary is a 65 km stretch of the Ganga River, from Sultanganj to Kahalgaon (25°17'23" N, 86°55'48" E), in Bihar, notified in 1991 for conservation of the Gangetic river dolphin (*Platanista gangetica*). The area of the Sanctuary is prone to changes due to inundation of the floodplains and the meandering channels of the Ganga River during monsoon. The river stretch, particularly a 36 km stretch from Sultanpur to Bhagalpur, is a paradise for breeding birds because of the presence of a large numbers of sandbars.

About 65 km of the Ganga River flows through the Vikramshila Gangetic Dolphin Sanctuary. It is the only dolphin sanctuary in India and hence, is crucial for the conservation of the Gangetic river dolphin, the national aquatic animal. Other important mammalian fauna include the smooth-coated otter (*Lutrogale perspicillata*). The Sanctuary is also identified as an 'Important Bird Area' by BNHS for its rich avifauna. The Sanctuary is home to hundreds of Indian skimmers (*Rynchops albicollis*), Pallas's fish eagle (*Haliaeetus leucoryphus*), greater spotted eagle (*Clanga clanga*) and lesser kestrel (*Falco naumanni*). Greater adjutant (*Leptoptilos dubius*) and lesser adjutant (*Leptoptilos javanicus*) have also been reported from the Sanctuary. The Sanctuary is also home to a sizable population of gharial (*Gavialis gangeticus*), a variety of freshwater turtles and numerous fish species.

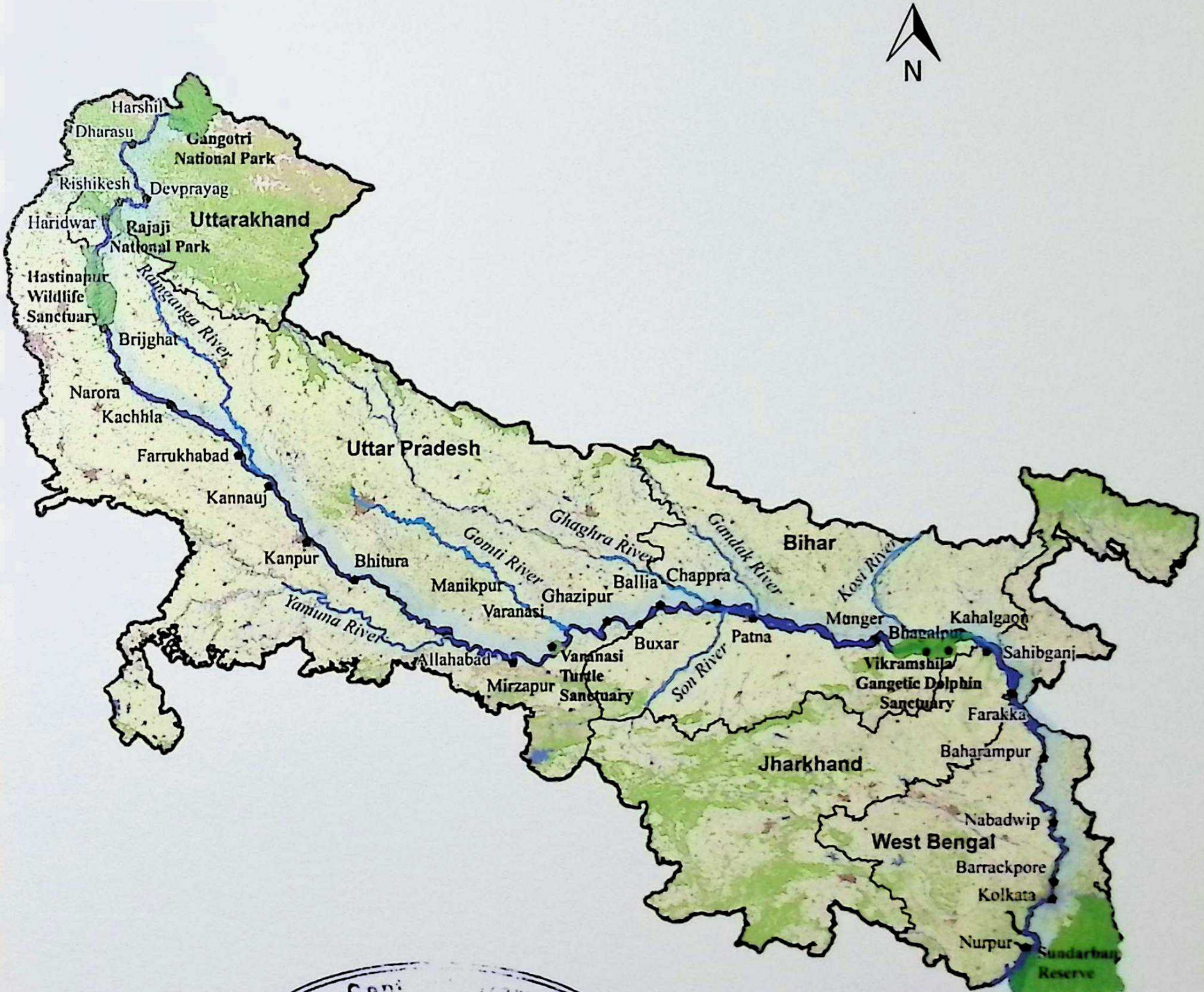
SUNDARBAN BIOSPHERE RESERVE

The Sundarban is the largest delta in the world and consists of 10,200 km² of mangrove forest, spread over India (4200 km²) and Bangladesh (approx. 6000 km²). Named after the mangrove plant Sundari (*Heritiera minor*), it is located in South Parganas district of West Bengal in India and the Khulna and Backarganj districts in Bangladesh. The Sundarban Biosphere Reserve (21°10'46" N, 88°58'21"E) includes the Sundarban Tiger Reserve, Sundarban National Park (core area), Halliday Island and Lothian Island Wildlife Sanctuaries with Sajnakhali Wildlife Sanctuary as its buffer area. It is a UNESCO World Heritage site, an 'Important Bird Area' and a proposed Ramsar Site. The mangroves reduce the fury of cyclonic storms and prevent coastal erosion caused by tidal action.

About 50 km of the Ganga River flows through the Sundarban Biosphere Reserve. Champion (1936) classified the vegetation of the area as moist tropical seral forest with beach and tidal forests. Sundarban has extremely rich diversity of aquatic and terrestrial flora and fauna.

Over 200 species of birds have been reported from the area including the rare and elusive masked finfoot (*Heliopais personatus*). Sundarban also hosts the largest population of estuarine crocodile (*Crocodylus porosus*). The mangrove forest of the Sundarbans is home to tigers (*Panthera tigris*), with perhaps the largest tiger population in the world.

PROTECTED AREAS ALONG THE GANGA RIVER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Manikpur
Varanasi
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Gandak River
Bihar
Kosi River
Yamuna River
Allahabad
Mirzapur
Varanasi Turtle Sanctuary
Buxar
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